THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE RIGHT TO WORK.

THE strike of electrical wiremen in the London District has been a half-hearted affair from the beginning, because it was generally recognised from the first that an increase in wages was due. Quite a number of the best contractors were paying their men more than the Trade Union rates when the dispute commenced, and it seems certain that 10½d. will be the recognised rate for wiremen working within the London area. While the number of men on strike is a comparatively small proportion of the total employed, we hope that the strike will not end without a definite agreement being come to between the Electrical Masters' Association and the Electrical Trades Union. If this is not done the industry will suffer from isolated strikes on points which should be settled now. We believe we are correct in stating that the big point of difference outstanding is that of the right of any man who is not a member of the Trade Union to work in any capacity. This point is raised in the first rule of the set recently issued by the Electrical Masters' Association, which reads:—

No exception shall be taken to the employment or non-employment of any workman in the electrical trade on the ground that he is or is not a member of any organised trade society, neither shall any exception be taken to the employment of a workman in any other trade on the ground that he is or is not a member of a trade society.

The Electrical Trades Union has strongly objected to this clause, but we believe that the older and stronger Unions are more intimately concerned. Their endeavour has been for years to make themselves so strong that they can prevent a non-Union workman from obtaining any employment which will necessitate his working alongside of a Unionist.

The numerous strikes which have had their origin in this endeavour have widened the breach between employers and employés, as they have also retarded trade developments. In the present instance, if this clause is not agreed to, an electrical employer, even assuming that all his men on a certain job should happen to be members of the Electrical Trades Union, will be liable to have them come out on strike, because one man employed, say, in asphalting the forecourt of a large public building which is being wired for electric light, is not a member of a recognised Union.

We have received from the Manchester, Salford and District Building Trades Employers' Association a copy of an agreement signed on April 9th by this Association and also by the representatives of the District Committee of the Electrical Trades Union. We reproduce this agreement elsewhere in this issue, because it seems to us that it should help to clear up the dispute in London. We would especially call attention to Rule 10, which deals with points raised above, and which reads as follows:—

10. While agreeing not to place any obstacle in the way of men joining the Union, employers do not agree to employ Union men only.

We fail to see why if this rule is accepted by the electrical workers in Manchester, their Union should raise strenuous objections to a similar clause for London.

We also commend Clause 13, which prevents a strike or lock-out starting until the matter in dispute has been referred to a joint committee of employers and operatives.

A clear set of rules like these, signed and held to by both sides, would be worth the trouble and expense of the present dispute.

At the moment of writing, it is announced that among the proposals of the National Conciliation Board for the settlement of the building trades dispute is one for deleting the disability clause.

The Press reports relating to the conciliation proposals are, however, as usual conflicting. The *Times* report says that: "The members of the London Building Industries' Federation are to agree to work peaceably with non-unionists"; but a financial paper says that: "By the deletion of the disability clause and the alterations to the conciliation clauses," the men "will gain the right for the first time, to protest and object to the employment of non-society men."

THE MINIMUM WAGE.

After a fortnight's enforced idleness, which has cost the Yorkshire Miners' Association £120,000 in strike pay, the men have gone back to work on practically the same terms as they had before the strike. It is estimated that the total cost of the strike has been about £1,000,000 (one report multiplies this figure by five), and all because a few men—who were undoubtedly doing their best—could only earn wages very little above those who took things easy and got the minimum wage, whether they earned it or not. This was the real trouble in the area where the strike started, as in other districts where men were earning good wages the strike was very unpopular. In the Doncaster district it very nearly caused a split in the Association, in fact, we shall not be surprised if the men in the Doncaster area eventually form an Association of their own. The miner is very human, after all, and when he is personally doing well, and knows there is nothing more to be gained, he wants to be left alone; in this case it was only the influence of the Association leaders which kept the men out on strike.

As to the terms of settlement, it is practically decided that the collieries in Yorkshire shall be divided into groups or classes of mines with different minimums, *i.e.*, the minimum rate of wages will be fixed by the Joint District Board. Thus a lower minimum will apply to those pits where the seams are thin and more difficult to work on a profitable basis, than to the thick seams in the Doncaster district. Any colliery company can only pay such wage as is afforded by the selling price of the coal, and hence the prices obtained by the collieries vary, as well as the cost of working. In the Doncaster area, where prices obtained are good, owners can afford to pay good wages, and the men employed at these collieries are receiving probably one shilling a day more than those in the Barnsley or Rotherham areas. But no Act of Parliament can alter these conditions; hence the necessity for a low minimum wage, if this is to apply throughout the whole county. Unfortunately, however, the men seem to think the minimum wage ought to be the *average* wage of the county, and instead of its being a "piece work" wage, it is fast coming to be looked upon as a time or day-rate wage, without any responsibility as to tonnage produced. Such conditions in a mine—except, perhaps, where the "butty" system is in operation—are impossible, owing to the difficulty of efficient supervision. In the "butty" system one man is responsible for a number of working places or a length of "long-wall" face, and has a contract price for getting the coal out, doing all timbering, stone work, &c., and employs the workmen under him and pays them. Frequently the "butty-man" may have left for himself £10 or up to £20—but he has to see that the other men work and that the coal is got out, or he may get nothing. But this system does not suit the workmen, and they are beginning an agitation to have it entirely abolished, or to secure that *all* the money earned shall be "pooled." They object to the butty-man having so much money, and likewise to his "bossing" propensities. Hence there are difficulties all round.

In Durham and Northumberland an agitation is proceeding to have the minimum wage made into the county average wage. At present the minimum is below the county average, but the point that smarts most is the rule that no workman is entitled to receive the minimum wage unless he has worked *full time*. In Yorkshire and other districts the workmen are asked to put in 80 per cent. only, and the north-country workmen want to know why? They forget that they work less than *eight* hours per shift—from 6½ to 7 only—and not only that, but they make every alternate Saturday a holiday, or only work 11 days per fortnight, against 12 in other districts. Again, the wages are lower because the men are provided with free houses and free coal, whereas, in other districts, workmen have to pay rent and buy coal. Owners in Northumberland and Durham would be very glad indeed to put their pits into line with those in other districts—that is, to pay higher wages on condition that the men work the full eight hours and pay house rent and buy coal. This, however, is not what the men want; they wish to retain all the advantages over their brother workmen in other parts of the country, and to be paid the same rate of wages.

In Scotland, too, the miners are resisting a claim by the owners for a reduction of wages of 1s. per day. Their present earnings are 7s. 6d. per day, and the owners say they cannot afford to pay this rate, owing to the increase in working costs and the reduction in the selling price of coal, which has dropped 1s. 6d. per ton from the recent high prices. Lord Balfour has been appointed neutral chairman, and his award is final and must be accepted by both parties. Unless, however, the award is in favour of the workmen, we doubt very much whether they will accept it peaceably, judging from what has occurred in other districts.

There should never have been any Minimum Wage Act, or any Eight Hours Act—the men undoubtedly are disappointed with both, as at Cannock Chase district, where both Acts have resulted in the men earning less money than they did previously, and it would be a great blessing to this country if both these abominable and mischievous pieces of legislation could be repealed. We are afraid, however, that the rank and file supporters of the Government of this country have much to learn before this will happen. The only other way is for the coal owners to combine and fight—as undoubtedly they will have to fight sooner or later—and the Minimum Wage Act, unless repealed before bad times come upon us, will be responsible for very much trouble and suffering, which will not be confined to the coal trade, but will more or less involve every industry in the country. We are still a long way from the millennium, which the pitman so earnestly desires—it is likely to remain far distant so long as workmen are taught that the less work they do the more there is left for everyone else—and the pitman especially must learn that he cannot expect to go on continually receiving 7s. 6d. for only 7s. worth of goods. At present the 6d. he does not earn is coming out of the pockets of the public, but they will find out in time, and we think when they do so they will begin to object, and will probably take a hand in giving the miner a lesson which he is beginning to stand in need of very badly.

London's Electricity Supply.

The supply of electricity in the metropolitan area, covering 700 sq. miles, and affecting a population of some seven millions, is a gigantic problem, offering immense possibilities, and involving equally grave responsibilities. At present, viewed as a whole, it is notoriously heterogeneous and unorganised; were it not so serious and lamentable a fact, it would be nothing short of ludicrous to observe that within that area no fewer than 49 different systems of supply are in vogue, and that if a consumer moves from one parish to the next, the chances are at least 10 to 1 against his lamps, motors, cookers and radiators being suitable for use in his new quarters.

The situation is absolutely without a parallel throughout the world, and throughout the history of electricity supply, and like many other anomalies, its origin is undoubtedly traceable directly to the action of Parliament in the early days of the industry. To aggravate the absurdity of the position, large new power stations are now being erected within the area, which will bear no intentional relation to those already existing. It was high time, indeed, that the London County Council, as the leading authority concerned, should institute an inquiry into the subject with a view to finding some way to bring order out of this wild chaos, and the report of its technical advisers, Messrs. Merz and McLellan, of which we commence an abstract elsewhere in this issue, will be read with interest, though with mixed feelings by many of those immediately affected. So weighty and complex a matter calls for the most authoritative and impartial discussion, and we are glad to be able to place before our readers a review of the report by Mr. C. H. Wordingham, whose position is a guarantee of freedom from bias and whose reputation entitles his remarks to respectful consideration. Whatever course the Council may decide to follow, there is no question but that the matter is of urgent importance, and no time should be lost in arriving at a firm decision upon its future policy, which will have an intimate bearing upon the well-being of every inhabitant of the metropolitan area.

Lead.

After the sharp reduction in prices which followed as the result of the fright due to the rather heavy selling here of American lead, the market has assumed a steadier tone, and at the reduced prices ruling a very fair business has been done by consumers. The market was badly jarred by the sales of United States domestic lead, for the necessity of finding an outlet abroad for such material, showed beyond all question that general trade across the Atlantic was in a bad way. Under ordinary conditions the United States is a large consumer of imported lead mainly from Mexico, hence the fact that not only had the country sufficient material of domestic production to provide fully for home needs but to permit of exports, came as a shock. The severe fall in the price had the effect of putting a stop to further selling, at all events for a time, for the London price was well below New York parity, and this condition still persists. It seems to be the present policy of leading London interests to keep the price here at a level sufficiently below that of New York to check shipments from the United States to Europe, and their efforts in this direction have so far been rewarded with success. Of course there is a chance that things may go worse in the United States again, and that the reduction of prices across the Atlantic would permit of further selling for export, but for the present this phase seems to have passed. The outlook is moderately satisfactory again meanwhile, and it remains to be seen what direction things will take across the Atlantic. There has been a fair quantity of United States lead come into this country lately, all of it to Liverpool and Manchester, and there is a good deal still to come, though some of the estimates of the total quantities sold for export from America are regarded as being exaggerated. The arrivals from the other side of the Atlantic have helped to relieve some of the more pressing needs of consumers, while invisible stocks can hardly be said to exist so far as the works of consumers are concerned. There has been an increase in the arrivals of lead this year for the three months of about 2,400 tons, the total being 55,273 tons, against 52,878 tons in 1913, so that it seems apparent that in spite of the shut-off of supplies from Mexico, there has been an increased output elsewhere. If not this, then the consumption in other parts must have fallen off to an extent sufficient to enable material to be forwarded to the British market, which otherwise would have been consumed elsewhere. For the time being the outlook is for a moderately steady market at the reduced prices now ruling. Unless America improves there is not much likelihood of prices in London being advanced to any extent. As far as the United States is concerned, things in pretty nearly all industrial channels seem to be rather bad, notably in the iron and steel trades, while although lately the consumption of copper as reflected in the monthly deliveries published by the American Copper Producers' Association, has improved from the miserably low total seen at the end of last year, there is still ample room for improvement in the electrical trades across the Atlantic. A restriction in the consumption of other staple metals cannot have proceeded without a restriction in the consumption of lead, and the position across the Atlantic therefore deserves close watching. It may be taken for granted that in the recent instance at all events, the holders of the lead which was sold for export wanted the money which it represented more than they desired to hold an accumulation of base metal. It is possibly significant of a continued relaxation in the position that April lead should have been declared as long ago as last week.

That Lost Ticket.

It is surprising how many people there are up and down the world who are unacquainted with their legal rights, notwithstanding that everyone is presumed to know the law.

We constantly hear of cases in which a tramway passenger, having lost his ticket, refuses to buy another, and is consequently brought to book by the company. In a case of this character recently heard at Cardiff Police Court, it was made clear that people who ride on the Corporation tramcars must not only pay their fares, but must also preserve their tickets to show they have done so, and the only way to meet a case of a lost ticket is to buy another. A man was summoned for riding on a Corporation car without having paid his fare. It was proved that the defendant could not produce a ticket to show he had paid it. Defendant said the conductor knew he had paid. Defendant said he had paid his fare, and when he saw the inspector come on the car he looked in every pocket for the ticket, but could not find it. When the inspector told him to look in his pockets, he told him that he had already done that without success. He found the ticket after he left the car, and had written to the manager explaining the facts.

The Stipendiary, in addressing the defendant, said:—"You must know, as an intelligent man, that it is the duty of the inspector to have some evidence that you have paid, and the only evidence he can have is your ticket. It would be the easiest thing in the world for dishonest people to say: 'I have paid my fare and lost my ticket.' What would be the result to the Corporation? The cars would be run at a loss, and the ratepayers would have to suffer. You are fined 10s. and costs, or 14 days."

What the public wholly fail to realise with reference to a case of this kind, is that on making application to the company the fare overpaid will be refunded. The company would be practically bound to refund, and any Court of Justice would compel it to do so on the sworn statement of the passenger that he paid twice over. No doubt the cost of recovery would make the remedy expensive. The 1d. stamp on the letter claiming repayment would cancel the 1d. stamp sent by the company. But the remedy is there; and those who rail at tramway companies for making a very sensible rule as to showing tickets should keep this fact in mind.

LONDON ELECTRICITY SUPPLY.

By C. H. Wordingham, M.Inst. C. E.

Messrs. Merz and McLellan's views on the way in which London can be best supplied with electrical energy were described by them with great thoroughness in the witness box, some eight or nine years ago, when they were promoting the Administrative County of London Bill. These views, as shown by the lengthy Report, with longer Appendices, which they have just presented to the London County Council, have undergone but little change, except that they now apparently realise that they must not rely upon power alone for getting the enormous load which it is necessary to assume in order to justify their conclusions, and they fall back on a phenomenal development of electrical heating and cooking. The importance of the distribution, as compared with the generation, of electrical energy is now more fairly recognised than at the earlier period referred to.

One cannot but be struck by the sense of absolute confidence that the authors have in their own views which pervades the whole Report. They refer to other "schools," but they seem rather concerned to demolish all arguments that do not accord with the scheme they favour than to weigh judicially the opposing considerations. In other words, their attitude towards the technical portion of the problem set them seems rather that of the witness, or counsel, than the judge, but it does not necessarily follow that their conclusions are on that account wrong.

The scheme propounded is no less than the absolute scrapping of all existing metropolitan generating stations, whether owned by companies or municipalities, and, to a large extent, of their distribution systems also.

There can be little doubt that the main principles enunciated are correct if virgin ground lies before the engineer. They are well-known, and, in fact, lie at the root of the idea of a central station, as compared with a number of isolated installations:—diversity, with consequent improved load factor; increased scale of operation, with consequent larger units of plant, securing lower outlay per kilowatt, decreased cost of attendance, &c. All this is the oldest of ancient history, and there can be few who do not take these principles as axioms of central station design.

Exactly where the limit to increased economy by concentration must be set may be open to discussion; Messrs. Merz and McLellan point to 30,000-kw. generators as *faits accomplis*, and say that 50,000-kw. generators are in sight. They may be, but it is more than doubtful if there is any appreciable gain in economy in going above 15,000-kw. or 20,000-kw. sets, and certain drawbacks necessarily attend the larger sizes. On the basis of 50,000-kw. sets they put the maximum size of single station at 500,000 kw.

The authors anticipate great economy and substantial advantages from putting the generating stations a long way down the river. The former is based chiefly on the ground of lower cost of coal; the latter comprise facilities for coal storage (a very important point in view of the increasing severity of strikes); the possibility of by-product recovery, and the hygienic advantages of burning the fuel out of London. No clue is given to the kind of by-product in mind, but gas engines of 50,000 kw. can hardly be contemplated. Great stress is laid on the hygienic gain, but it may be doubted whether much need be made of this if the scheme is otherwise sound; it is not the factory chimneys, but the tens of thousands of domestic fires that poison the atmosphere. If Messrs. Merz and McLellan's new stations can abolish these, they may well be forgiven their station chimneys, even if situated in the heart of London.

It is admitted that the cost of transmission would be heavy, but it is stated that this would be more than compensated for by the advantages. Like a good many more *ex cathedra* statements in the Report this may well be doubted.

Some of the arguments used in support of the scheme are less sound. For example, the myth of there being some essential difference between lighting and other uses of electrical energy is brought out. The load factor of street-lighting compares very favourably with a large proportion of motive power, while all-day basement lighting easily beats any power load and still more a heating load, which, after all, is just as much a winter load as ordinary lighting, though, of course, it has a better *daily* load factor. Cooking, except in large restaurants and hotels, cannot be expected to give a very high load factor, and it may well come on a very nasty part of the load curve.

After reading the Report, one cannot help asking oneself: What is the magic talisman which the authors possess that will enable them to do the same work as existing concerns at a vastly lower cost? Let it be granted that the use of very large units will reduce their capital outlay for generating plant and some of their running costs, they will still have to pay the same as other people for cables, for excavation, for re-instating of pavements, and for all the miscellaneous etceteras that run up the cost of every consumer's service. Many of the existing undertakings are run by engineers of long years of experience in central station work, dating back to the inception of the industry, men who join conspicuous business ability to ripe and sound engineering knowledge. They have the same market open to them as Messrs. Merz and McLellan: why are all their efforts doomed to failure and to be hardly worthy of consideration, while success is certain to crown the new undertaking and enormous reductions in costs of generating and distribution are to be made? Surely not because their stations are above instead of below the bridges and because they use 15,000-kw. instead of 50,000-kw. generators.

The real crux of the question lies in the fact, however, that the engineer is not confronted with virgin ground. He is not dealing with a prairie in which a great city is going to be erected round his mains. The ground is already covered with a network of mains traversing all streets in which a profitable demand exists (and some in which it does not), and this network is supplied from generating plant which is in existence and which has cost money to buy. Unless spoliation is to take place, this money has got to be written off somehow, and it must be a burden on the new undertaking. It means that twice as much plant as is necessary at the present time is to be provided, and, to a large extent, twice as many mains. Piling up capital expenditure must tend to keep up the price to consumers rather than to lower it, and it is difficult to see how any substantial reduction on present prices, in view of these augmented capital charges, can be made unless a very large annual loss is faced for a number of years, and where is the money to come from to make this good? Unless the price is brought phenomenally lower, how is the enormous demand to arise? and if the enormous demand is not there, how are the costs of production to be lowered in the striking manner foreshadowed so confidently?

Messrs. Merz and McLellan say, in effect Never mind, you have got to wipe out all this plant because it was not bought to-day, and is not the biggest that *can* be built at some distant date in the future; the sooner you do so the better it will pay you. But will it? It may be doubted, too, whether it is wise policy to be in such a hurry to wipe out

plant much of which is, after all, of the most modern, such, for example, as recent additions to Deptford, Lot's Road, and the L.C.C. Tramways generating station. Finality in generating plant has certainly not yet been reached, and the London County Council, who recently scrapped nearly new reciprocating engines with their alternators at their Greenwich works, may well pause before they say that the plant referred to in the Report is so much better than that they have just installed that the latter must be scrapped; the new plant may want similar treatment itself in two or three years' time, and what then? Surely the scrapping process must stop somewhere.

The practical difficulties of carrying the scheme into effect are enormous, quite apart from the cost. It is seriously contemplated to lay new distributing mains throughout the area; this necessarily means taking up all the streets, and, apart from the public inconvenience, the difficulty of finding room for the mains in the congested space beneath the footpaths (for distributing mains would hardly be tolerated under the roadways) is far greater than the authors appear to contemplate. Some of the provincial towns are bad enough, but the conditions in London must be experienced to be believed.

In addition to these low-pressure mains, a whole network of high-pressure mains is contemplated. It is rather airily stated that transformers would have to be installed "at intervals" to give the supply to the low-pressure mains; these transformers would require sites for their erection which would be costly and difficult to obtain.

Other difficulties connected with minor points would arise which would be found to be of very serious proportions in practice. The greater number of consumers are proposed to be supplied from three-phase mains, though a favoured few are to have continuous current at a pressure of 250 volts. No consideration appears to have been given to the scrapping that the unfortunate consumer would have to do to get the advantages of the new supply. The experiences of those companies which have simply doubled the pressure to their consumers would not show the problem which the new authority would have to face in regard to this matter alone in a very alluring light.

Into the merits of the scheme itself it is unnecessary to enter, but it seems a doubtful benefit to a consumer to be given three-phase instead of continuous current, especially if he have arc lamps or variable-speed motors to run, or electric vehicles to charge, or even to have the pressure of his continuous current put up to 250 volts. From the suppliers' point of view, too, it is a serious drawback to be shut out from the use of batteries on the network for all time, especially in view of the recent practice in such large towns as Manchester and Birmingham.

In forecasting the future of electrical supply in London, one very important factor does not appear to have received consideration, viz.: the cost of consumers' apparatus. The whole fabric of the Report rests on the assumption of a very large demand, and it is assumed that this will arise if energy be supplied at a very low price. This, however, is only half the tale, as every station engineer knows to his cost; at however low a rate he may offer his energy, he has always to meet the difficulty of the high first cost of electrical gear, and this must militate against the vast development contemplated. It may be argued that standardisation of pressure, frequency, &c., would tend to lower this first cost of gear, but it is open to question whether any one town, even if of the size of London, would be able to affect the cost of manufacture to any appreciable extent by standardising within its borders. Even if the sales of plant and apparatus in London were great enough to affect appreciably the cost of their manufacture, it would, in the important case of incandescent lamps, tend rather to augment the price, there being nothing the lamp-maker wants less than a rigid standardisation of pressure, because he would then have no market for his throw-outs of lamps intended for the standard pressure.

The authors, having laid down the lines on which they consider the future supply should be provided, proceed to discuss the ways and means of carrying their recommendations into effect, having regard to the complications of the existing state of things: "65 authorities (apart from traction undertakings) supplying electricity upon 49 different systems from 70 generating stations, containing 585 engines." It must be confessed that this is not a promising basis for the introduction of the scheme laid down as ideal, but the authors attack the problem boldly, and examine the various courses open in a very complete manner.

Bulk supply, though useful, they do not think would go nearly far enough, and without powers for compelling the existing authorities to take the bulk supply provided, progress would be slow and the financial prospects poor. More rapid progress they think would be made if the new concern were allowed to compete on Power Act terms, and the commercial results would be better. Much better results, however, from the point of view of the new undertaking would ensue if it were to compete with existing undertakings without the limitations imposed by the Power Acts, and the public would stand to gain, as the competition would certainly lead to lower prices. The gain would naturally be at the expense of the unfortunate existing authorities, and although they were never actually granted a monopoly, yet they would, it is recognised, be somewhat hardly used, and they might be granted a little consideration, such as permission to postpone the date of being taken over, or to insist upon being taken over at once before they were strangled.

The authors point out, however, that the most rapid and certain way of effecting the objects which they desire would be the amalgamation of all the existing undertakings. This might be done either by means of a public body or by private enterprise under suitable control, each course being accompanied by certain advantages and drawbacks which are pointed out. The conclusion arrived at is that the only complete and satisfactory solution is the establishment of a new undertaking with such powers as will enable it to concentrate production, standardise and unify distribution, and bring about the amalgamation of the various undertakings.

The form which this new undertaking should assume is then discussed briefly. A combination of all existing authorities is dismissed at once, and a combination of the company-owned concerns is not thought to be much more promising. In laying stress on the want of unanimity and cohesion among existing authorities, Messrs. Merz and McLellan have unquestionably a strong argument. It is now some nine years ago since they were threatened with the Administrative County of London Bill, and, instead of putting their house in order, the authorities have let the golden opportunity slip, and it now lies with those seeking to do away with them to question their ability to unite and their zeal in carrying out any unification if attempted, as well as the possibility of their raising the necessary funds. Due stress is also laid on the problem of including the municipal concerns. Such a scheme would, the authors think, be worth consideration if certain safeguards were provided.

Attention is called to the difficulties that any such scheme of amalgamation would put in the way of ultimate purchase by the London County Council, but if the best means of providing a cheap supply for the public is the only object in view, it seems rather inconsistent to attach any weight to such considerations.

Other alternatives are next considered, *e.g.*, an independent new company, a public authority, or, finally, municipal ownership and control with operation by a private authority. After going into the pros and cons of each, the last is finally recommended. It is admitted that there is no precedent for such an arrangement in this country, but it has found favour in a number of foreign towns, and an analogous arrangement exists in connection with the Indian railways.

Like many large schemes, this one appeals to the imagination on account of its very magnitude. It all sounds so sweeping, so grand, so evident. But in sober fact, less ambitious and less attractive projects often effect the object in view far better. It seems as though it cannot be right to waste so much valuable work already done, and to throw away so much modern and highly efficient plant. It ought to be possible to develop the best of the present stations and to shut down the inefficient ones without undue cost, and every effort ought to be made to bring the various owners together without destroying their several properties. Notwithstanding what is said to the contrary in the Report, a number of inter-connected stations should give a security of supply at least as great as the scheme proposed, and there ought to be no insuperable difficulty in generating and distributing at a very low rate.

There would be this important advantage over the big scheme: the undertaking would not be burdened with capital expenditure or duplication of plant and mains, but would be able to start reduced prices at once without loss. The spent capital has got to be written off in any case; it must surely be better to do this without spending additional money.

Detailed though the Report is in some ways, there is much vagueness as to how the proposal recommended would be worked out. One cannot help feeling that if such a scheme is to be carried to a successful issue, it must involve heavy loss on those who have borne the burden and heat of the day, and if this were the case, low-priced electrical energy for London would be too dearly purchased.

The Report Summarised.

The report of Messrs. Merz and McLellan to the Special Committee of Electricity Supply of the L.C.C., which has been awaited with considerable interest, is a lengthy document with numerous appendices; the authors point out that it does not deal with questions of general policy or with arguments for and against the different forms of control except in so far as these affect the technical and commercial aspects of the problem.

Whatever form of control is adopted, they recommend the establishment of a new undertaking to carry out the technical changes which they show to be necessary.

Their investigations, they say, prove that it is possible gradually to bring electric lighting, heating, and cooking within the reach of the majority of Londoners, as well as to extend industrial electrical uses, and when this takes place the ultimate demand will be so great that the mistakes made in the past should not prevent the early initiation of a new policy.

Since the L.C.C. first considered the question of bulk supply, there has been a serious increase instead of a decrease in the number of electrical authorities and generating stations in Greater London, and the authors attribute the present state of affairs to the action of Parliament in attempting to safeguard the supply of electricity. They point out however, that the competition of other forms of light and power is a most important factor in reducing prices.

The authors consider that on a conservative estimate the electrical requirements of the near future will be more than twenty times the present output of the London lighting undertakings, and refer to the necessity of improving the load factor—as a means of reducing the price—by developing particularly the heating and cooking load.

With the comparatively small amount of heat required under London temperature conditions, any difference in cost between electricity and other forms of heating is often more than counterbalanced by the convenience, cleanliness, and saving of domestic electric heating.

Fundamentally to obtain the highest load factor involves the use of electricity for as many purposes as possible, which can only be attained if the selling price is reduced to a satisfactory figure, which in turn can only be done by initiating a new policy at an early date. They consider that the conditions in London are such as to make it one of the finest fields for electricity supply in the world, and that its credit and ability to raise capital are unparalleled, and add that the capital already expended upon electric supply in London, though a large sum, is not large in relation to its ultimate needs, and should not prevent the initiation of a new policy which will improve the existing state of affairs.

The report discusses two alternatives under the heading "generation," viz.:—(a) the extension of 8 or 10 of the best existing stations and gradual abandonment of others, and (b) the gradual abolition of all stations in or near the Metropolitan area and concentration of production on sites well outside.

The former would be easier to carry out and might save transmission cost, but the latter would effect a saving in production cost more than sufficient to balance the increased cost of transmission, and would allow for unlimited expansion and by-product enterprises.

The choice between the two courses is considered fundamental, and the most important step in deciding the policy to be adopted by the Council. The areas considered are the Metropolitan Police area and a central area of 100 square miles covering most of the County of London.

The investigation has not been confined to a comparison with existing stations, but calculations have been made of the cost of production with ten "model" stations erected approximately on existing sites. This is compared with the costs of production and transmission with a station equivalent to the ten, but situated down the river.

Stress is laid on the influence of the size of generating plant, and it is pointed out that as a general rule it is economical to continue concentration so long as it is possible to do so by increasing the size, not the number, of the individual generating units.

The large unit relatively costs less, is more efficient, and requires less labour than the small one; generating units of 25,000 KW. are in use to-day, and 30,000 to 40,000-KW. machines have been developed.

The present arrangement of generating stations, mostly unconnected with each other, is unfavourable to reliability of supply; the abandonment of the existing stations would be gradual, and before its completion the area would be obtaining its supply from several different interconnected sources, the new plant being housed in several separate stations on both sides of the river, where sufficient water and fuel storage facilities could be obtained, which would not be the case were three or four existing up-river sites utilised.

Consideration has also been given to the possibility of generation on the coalfields, but the report suggests that this matter should await the further development of the Kent coalfields; that freedom should be retained to obtain coal from as many sources as possible, and that increased transmission costs would cover any saving in carriage, except for loads at high load factor.

The following conclusions are arrived at as the result of this investigation into the question of generation:—

(1) Assuming all the existing generating stations for the supply of light and power in the central area were in the hands of one authority, it would pay that authority to shut them down, sell most of the plant, and generate all the energy they produce, on sites down the river.

(2) The saving in *working costs** which the existing undertakings in the "central area" could effect by obtaining their current from such a concentrated plant supplying for all purposes would be not less than 18 per cent. or about £170,000 a year, *after allowing* for all capital charges on the new plant and mains.

(3) The initial capital outlay required for this purpose, allowing for growth of demand during the next 4 years, would be between £6,000,000 and £7,000,000.

(4) It is not advisable at the present stage to generate at stations situated at the coalfields.

(5) To supply the general domestic demand from 10 model stations on any of the present sites would cost, including capital charges, at least 20 per cent. more than from plant concentrated on sites down the river.

(6) If the comparison be made, not with ten new stations, but on the assumption that the existing plant in the 10 best existing stations be re-arranged and utilised to the best advantage, the policy of extending on the existing sites shows to still less advantage.

(7) If the necessary concentration of plant could be effected by extending two or three of the existing stations "below bridge," the saving in the cost of transmission would be outweighed by the disadvantages of such a policy, even on financial grounds.

(8) A policy initiated by the concentration of production on sites down the river is the right one for London, on financial grounds, apart from its other great advantages. Its immediate adoption is essential to economy.

The conclusions are based upon technical and commercial considerations. It can be shown that the actual financial gain to London which would result from such a change would be much greater than the direct economies.†

On the subject of "distribution," the Report states that one-third of the 27 millions invested in electricity undertakings in Greater London is represented by cable and house services. Some 49 different systems and pressures of distribution are in use, which might be gradually reduced to about one-third without very prohibitive expenditure, but further reduction would be costly. In nearly all cases the existing networks would be quite unable to cope with the great increase in the demand for power and heat, especially in residential districts, which would result from a general reduction in price.

To obtain this price, the cost of distribution must be reduced, and this could only be done by the introduction of alternating current distribution for dealing especially with the demands other than lighting.

The conclusion arrived at is that the present distributive systems in the various districts, instead of being generally extended, should be supplemented as required by a high-pressure, 3-phase, system—transformers being installed at intervals for supplying the consumer at low pressure through distributing cables. Such a system when laid would cost at least £10,000,000 less than the extension of the existing direct current networks which would otherwise be necessary to meet the general domestic demand. Its adoption would, in addition, result in reducing the total operating expenses of the undertaking by 12 per cent. As and when this new network was laid, all additional power, heating, and in some cases lighting would be supplied from it. As the supply given through it would be at a lower price than that from the existing mains, it is obvious that many consumers would also change over their present installations to it, and it would usually not be necessary to extend the existing distribution systems.

*This saving, in conjunction with the present sinking funds, would enable the existing generating plant to be written off by 1931.

†Some recent and careful investigations into this question elsewhere, indicate a possible saving approaching £5 per head of population per annum.

In some districts the existing networks might suffice to supply the heating and power loads also, for a time, but one of the aims would be to encourage in all possible ways the *gradual* laying down of a standard 3-phase network with a view to the ultimate standardisation of distribution in London. This might possibly be assisted in some cases by the loan of capital for the purpose from some central authority, to existing authorities.

There should be two systems of distribution standardised for London:—

(1) A 3-phase high-pressure system, as referred to above. This would be laid as the existing systems became loaded up, and would eventually replace the existing systems entirely in most districts.

(2) A 500 volt 3-wire D.C. distribution system for lighting, consisting largely of existing networks. This might eventually be done away with in many districts, but where it was wise or economical to retain it, it would be retained.

Stress is laid on the urgency of standardising the primary distribution throughout London, that is of high-pressure mains laid for supplementary use or connecting up existing stations. The frequency of 50 cycles per second is considered the most suitable. While it is regarded as essential that production and primary distribution should be in the hands of one authority, and important that the secondary distribution should gradually be standardised, it is not considered as absolutely essential that the distribution and sale of electricity should be entirely carried out by one authority—at least at first—though that arrangement would probably lead to the most rapid development.

The reporters state:—

While in our opinion the time is ripe for beginning the standardisation of distribution methods *technically*, it is not essential at the moment so completely to unify the *commercial* side of retail distribution. If there were a number of different bodies using different commercial methods of selling electricity it would not impede the development of electrical supply as much as if a number of different technical methods were used.

After carefully considering the whole matter, we have come to the conclusion that having in view the large amount of development work that has been done by both local authorities and companies in London, the most practical arrangement as regards distribution would be one on the following general lines, though, in practice, numerous modifications would doubtless be employed in different districts.

Under the scheme suggested:—

(1) No general extension of the existing networks would take place, but there must of course be slight additions and alterations from time to time as well as connections to new consumers.

(2) In a certain number of districts the complete undertaking would be immediately, and in other districts gradually, taken over by some central authority.

(3) At any rate in the majority of other cases a bulk supply would be taken.

Under these conditions the following would be the best arrangement in connection with the existing and proposed new networks, respectively:—

Existing Networks—Extensions.—Except in cases where the whole undertaking is acquired by the central authority, house services and short extensions might still be done by the existing authority.

Operation and Maintenance.—The same applies to the operation and maintenance of existing networks.

Sale of Electricity.—In cases where the network is retained by the existing distributors, selling might also be retained by them. In some cases the sale of electricity might be retained by them even though the network was handed over to the central authority.

New Networks.—As regards the new networks which we recommend should be laid to supplement the existing networks as these become loaded up, we think the following should govern the policy adopted:—

Design.—This must in all cases be in the hands of the central authority.

Laying.—The actual work of laying, or at least the breaking-up of streets and reinstatements, might be retained by the existing authority, if so desired.

Ownership.—The new network might be in the hands of either the central authority or the existing authority, the other terms of the arrangement being varied accordingly.

Operation and Maintenance.—Except as regards the breaking-up and reinstatement of streets, this would, as a rule, need to be in the hands of the central authority.

House Services.—Here again except possibly for actual breaking-up of streets, both the laying and the maintenance would usually have to be in the hands of the central authority.

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Sale of Electricity.—The sale of electricity to all retail consumers might usually, if desired, be retained by the local distributors, whether they own the network or not.

It is obvious that many modifications of the above arrangements based on the same general principles are possible, such for example, as combination of neighbouring authorities' distribution systems. Overlapping of existing mains should, of course, be abolished.

Ultimately, throughout London, both generation and distribution may be carried out by one organisation; in the meantime it will be necessary when making arrangements with the different distributors always to keep in view two points, viz.:—

(1) That nothing be done to hinder the ultimate unification and standardisation of distribution in London.

(2) That everything be done to reduce the price of electricity to the consumer and to increase its use. A sliding scale or other means of protecting the consumer should be negotiated for or insisted on in any new arrangements that may be made.

The report then proceeds to consider the possible methods of effecting unification of supply, the alternatives being: (*a*) bulk supply, (*b*) competition, (*c*) amalgamation, and (*d*) some combinations of these alternatives.

Bulk supply would not even remove the difficulties of the Council in 1931, and it would be difficult to make the adoption of such a supply compulsory by existing undertakings, although steps might be taken to prevent the extension of existing stations.

(*To be concluded.*)

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A special Civic Committee was formed recently in Montreal to consider the question of tube railways, and, generally, the transportation problems of the city. Nothing has yet been done, however, and it seems that, as a new set of aldermen will be in office before long, it has been thought better that a new Committee should go into these matters.

More than 2,000 delegates, representing a large number of Ontario municipalities, went to Ottawa a few days ago to ask the Dominion Government for the subsidy of $6,400 per mile for hydro-electric radial railways (as they are being called here), to which reference was made very recently in these notes.

The Premier promised that the Government would give the matter the fullest consideration. As this is one of the largest deputations which has ever presented itself at the Federal Parliament buildings its request is not likely to be forgotten.

Further examples of the extension of municipal ownership are shown by the ratepayers of Brantford, Ontario, having recently voted by a very large majority in favour of buying the local tramway system and by those of Kalso, B.C., having just decided to buy the plant of the Kootenay Electric Co.; these cases may be offset, however, by the town of St. Thomas, Ontario, where the municipal tramway system does not pay, and one of the citizens has offered to take it over and operate it for five years.

The City Council of Prince Rupert, B.C., the terminal point of the Grand Trunk Pacific Railway, is spending some $380,000 on an initial unit for a municipal hydro-electric plant. This city is likely to become a place of considerable importance during the next few years; it is situated on Kaien Island, about 500 miles north-west of the city of Vancouver.

The railway company has in progress works which will cost altogether about $7,250,000, while the Dominion and Provincial Governments are spending $450,000 and $300,000 respectively on public buildings, and the city is planning works which will take nearly $1,000,000.

Calgary, in Alberta, is to vote shortly on by-laws which, if passed, will authorise the expenditure of $1,734,600 on public works, $300,000 of which will be devoted to electrical requirements.

The electrification of the C.P.R. branch to New Westminster, in British Columbia, as well as several others in that Province, is said to have been decided upon.

The Nova Scotia Legislature has before it a proposed Bill for the incorporation of the Nova Scotia Tramways and Power Co., Ltd., with an initial capital of $5,000,000, with power to increase to $10,000,000.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Two-Rate Switch.

We have received from the Kartret Engineering Co., of Queen Anne's Chambers, Westminster, S.W., particulars of their Kartret patent two-rate switch, built in sizes for from 10 to 150 amperes running current.

This apparatus is designed to protect a two or three-phase squirrel-cage motor-circuit at starting, as well as during running; the circuit is fused at a higher capacity when starting than during normal running.

There are two switches in each phase, and each switch is in series with a fuse. The first operation closes all the switches together, when each pair of fuses is paralleled; directly the operator removes his hand, *i.e.*, when the motor attains running speed, this allows the handle to move forward slightly, and one switch on each phase opens circuit and cuts out its own fuse. To switch off, the handle is operated in the ordinary way.

The fuses for starting can be selected to suit the conditions, and in case of accidental overload the fuses will blow, whether the switch is in the starting or running position.

The switches are of the firm's patent type, with laminated brushes and sparking tips, and the apparatus is of enclosed iron-clad construction.

Ferodo Brake and Clutch Linings.

The Herbert Frood Co., Ltd., of Chapel-en-le-Frith, send us particulars of some tests carried out on fabric friction surfaces by the National Physical Laboratory during 1913.

The importance of such fabrics has increased greatly during recent years, and we understand that all the underground railways of London and Paris have for many years relied exclusively upon Ferodo fabrics for braking purposes, and that such fabrics generally last about three times as long as chilled iron. The N.P.L. tests were instituted by the company, and extended over 12 months; they bear out the firm's own experience. From the data obtained it appears that with standard Ferodo bonded asbestos, tested at speeds of 600, 2,900 and 5,600 ft. per min. and pressures per sq. in. of 20-176 lb., the coefficient of friction remained very uniformly at ·30 to ·32; similar tests with die pressed Ferodo bonded asbestos at speeds of 600 and 2,900 ft. per min. and pressures up to 66 lb. per sq. in. gave coefficient values of ·30 to ·33.

As regards the bonded asbestos, it is pointed out that such material is of great value because of its heat resisting qualities and small wear; the results show that hydraulic compressing improves the wearing qualities.

Similar tests as regards coefficient value of Ferodo fibre, at 600, 2,900 and 5,500 ft. per minute, and pressures of 16 to 39 lb. per sq. in., show results of ·70-·73, ·63-·64, and ·56 at the three speeds mentioned. Comment is made on the high coefficient value and slow wear. Increased temperature raised the coefficient value, which effect also followed an increase of pressure and speed; the value of the coefficient when lubricated was satisfactory, and the work absorbed high.

A comparison with other materials was made, from which it was found that Ferodo fibre absorbed 39,000 ft.-lb. per sq. in. per min. at 1 000 ft. per min., Ferodo die pressed bonded asbestos, 18,000 ft.-lb., and Ferodo standard bonded asbestos, 15,500 ft.-lb., at pressures of 60, 60 and 50 lb. per sq. in. respectively.

Nine other competitive materials tested gave values of 10,800 to 3,100 ft.-lb., under pressure varying from 40 to 10 lb. per sq. in., the test conditions being similar. The pressures for these nine materials were the maximum possible owing to the breaking up of the test pieces; similarly cut samples of Ferodo fabric were tested up to 176 lb. per sq. in. before commencing to give way.

The test results will obviously repay perusal by engineers and others interested in brake and clutch mechanism.

Copper.—Returns for mid-month (as tabulated by Messrs. H. R. Merton & Co., Ltd.) show an increase in European visible supplies and slight easing of price. Supplies in Great Britain on April 15th were 10,597 tons, or 109 tons more than at the end of March. French supplies had increased 329 tons in the same period, and total European risen from 26,755 to 27,203 tons.

Arrivals from S. America during the fortnight were well up to the average, and from Spain just on it. Shipments from Chile were very low at 550 tons, while Australian were average. Total deliveries for the fortnight still indicate a fairly brisk month, though not like March.

American supplies for March 31st, at 28,843 tons, show low, and with a considerable drop from February. The world's supply on March 31st, 54,972 tons, shows a loss of 6,968 tons on the month.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

In fulfilment of our promise, we now publish the complete list of contributions collected by Mr. Hugo Hirst as chairman of the Annual Festival Dinner. The Institution is placed under a great debt to Mr. Hirst for such a splendid achievement. We shall print the secretary's list of Dinner contributions, and other contributions received during the year, in our next issue.

	£	s.	d.
Acme Elec. Mfg. Co.	1	1	0
Acme Screw Co.	0	10	0
Adams, H. W.	0	10	6
Adams, L.	1	1	0
Addressograph, Ltd.	1	1	0
Alexander, G.	1	1	0
Allan, F. G.	0	5	0
Allan & Meggitt	0	5	0
Allen, David, & Sons, Ltd.	2	2	0
Allen, F. G.	0	5	0
Allen, Strong, & Co.	1	1	0
Allen, West & Co.	2	2	0
Alwood, K.	1	1	0
American Hard Rubber Co.	0	10	6
Anderson, Anderson and Anderson	0	10	6
Anderson & Anderson	0	10	6
Anderson & Munro	0	10	6
Anderson & Son, Ltd.	1	1	0
Andrews, F. E.	0	10	0
Angold, A. E.	1	1	0
Angus, G., & Co.	0	5	0
Anonymous	5	5	0
Anonymous	5	5	0
Anonymous	1	1	0
Anonymous	0	12	0
Anonymous	0	10	6
Anonymous	0	10	6
Archer, G. A.	0	5	0
Arculus & Co.	1	1	0
Armstrong, Stevens & Co.	1	1	0
Arnold, W. A., and Sons	5	5	0
Aron, Manfred	5	0	0
Aron, Maurice	1	1	0
Aron Electricity Meters, Ltd.—			
(Donation)	15	15	0
(Subscription)	10	10	0
Art Reproduction Co.	0	5	0
Ash & Lacy, Ltd.	0	10	0
Assersohn, D.	23	1	0
Attwater & Sons	2	2	0
Ault & Wiborg Co.	1	1	0
B. & D. C.	0	10	6
B. (F. W.)	1	1	0
Babb, T. G.	0	10	6
Bacon & Curtis	0	10	6
Bailey, W. P.	1	1	0
Baker, C.	0	5	0
Baker, C. E.	1	1	0
Baker, D. R.	0	10	0
Balcke & Co.	1	1	0
Balding & Mansell	2	2	0
Baldwin, J. W.	0	10	6
Baldwin, J., & Sons	1	1	0
Baldwin, Ltd.	5	5	0
Ball, F. W.	0	10	6
Ball, J.	0	10	6
Ball, S. W.	0	10	6
Barbour, J.	2	2	0
Barker & Allen	1	1	0
Baroni, A. M.	1	1	0
Barras, G.	0	10	6
Barry Graving Dock Co.	2	2	0
Bartlett, A. T.	1	1	0
Barton & Sons	1	1	0
Barton, F. J.	0	5	0
Barwell, C. J. W.	1	1	0
Bateman & Co.	1	1	0
Baughan, A. H.	0	10	6
Baxter, A. & F.	0	10	0
Bazeley & Sons	1	1	0
Beach, H.	1	1	0
Bean, R. F.	2	2	0
Beaven, C.	0	5	0
Becks, A. T., & Co.	0	10	6
Behrens, Miss	0	6	0
Bellows, J.	0	5	0
Bennett & Thorne	0	10	0
Bentley, H. L.	1	1	0
Bergtheil & Young	2	2	0
Berk, F. W.	1	0	0
Berkeley, A.	0	10	0
Bernstein, P.	1	1	0
Berry, Harrison, & Co.	1	1	0
Berry, Henry, & Co.	2	2	0
Berry, Skinner & Co.	5	5	0
Bielefeldt, P.	4	0	0
Birch & Workington, Ltd.	0	5	0
Birchter, K.	0	5	0
Birmingham Products Co.	0	10	6
Black, Mrs. M. W.	3	3	0
Blackburn & Powell	0	10	0
Blades, N.	0	5	0
Bland, H.	0	5	0
Blay, W. F., Ltd.	0	10	6
Blume, Charles	0	5	0
Blenheim, W.	0	5	0
Blessett, B.	0	5	0
Bohler & Co.	1	0	0
Boker & Kreuger	4	18	0
Bolding & Sons	0	10	6
Bolton & Sons	1	1	0
Bolton, W. M.	0	10	6
Bond, A.	0	5	0
Bonnella Bros.	1	1	0
Bonnella, D. H., and Sons, Ltd.	1	1	0
Booth, J., & Co.	1	1	0
Booth, J. G.	0	5	0
Boston, Thomas	0	10	6
Boston, P., & Sons	2	2	0
Bourne, A., & Co.	0	5	0
Bourne, J., & Sons	1	1	0
Bowerman Bros.	0	10	0
Bowthorpe, H.	0	10	6
Bowthorpe, W.	0	10	0
Boyd, W. R. E.	2	0	0
Boyes, L. F.	0	10	0
Boyes, F.	1	1	0
Bradley Steel Strip Co.	1	1	0
Bradstreet, W. J.	0	5	0
Braham, A. E.	0	5	0
Bray, Gibb & Co.	2	2	0
Brecknell, Munro and Rogers, Ltd.	0	5	0
Breffit, E., & Co.	1	1	0
Bressman, E. A.	1	1	0
Bridge, David, & Co.	2	2	0
Briggs, Thomas	0	10	6
Briscoe, W. H., & Co.	2	2	0
Bristol Elec. Safety Lamp Works	1	1	0
Bristows, Cooke and Carpmael	10	10	0
British Central Elec. Co.	0	10	0
Brittains, Ltd.	1	1	0
British Electric Calibrated Fuse Co.	5	5	0
British Electrical Equipment, Ltd.	1	1	0
British Petroleum Co.	0	10	6
British Sherardisers, Ltd.	1	1	0
British Systems, Ltd.	1	1	0
British Telep. Supply Co.	1	1	0
Brit. Thomson-Houston Co.	10	10	0
"British Trade Review"	1	1	0
British Traders' Association	3	3	0
British Uralite Co.	1	1	0
Brit. Vacuum Cleaner Co.	1	1	0
Broad, J. V.	0	5	0
Broadbent, F.	1	1	0
Broadhurst & Co.	1	1	0
Brocklehurst & Sons	1	1	0
Brooke, C. F.	1	1	0
Brook, L. H.	0	10	0
Brookhouse, R. H.	5	0	0
Brooks, Ward & Co.	0	10	6
Brunker, T. E.	0	10	6
Bruty, J.	0	5	0
Buchanan & Curwen	1	0	0
Bucknell, P.	0	10	6
Bullard, King & Co.	2	2	0
Bullers, Ltd.	5	5	0
Bullows, J., & Co.	0	10	6
Burrows, H. G.	0	10	6
Burton, Griffiths, C. W., and Co.	2	2	0
"Bury and Norwich Post"	0	5	0
Butler & Spragg	0	10	6
Byng, E. G.	100	0	0
Byng, F. G.	5	0	0
Byng, H. G.	23	3	0
Byng, L. G.	40	0	0
Byron Dyeing Co.	0	10	6
Byworth, J.	2	2	0
C. B.	0	10	6
Cable Accessories Co.	3	3	0
Cadby, G., & Sons	0	10	0
Calmon Asbestos Co.	0	5	0
Cameron, J. W., and Co.	0	10	6
Camilinat, E., & Co.	0	5	0
Canning, W. C.	1	1	0
Cannon, A. V.	0	10	6
Carbone, Le	0	10	6
Carbon Paper Supply	1	1	0
Cardboard Box Co.	0	10	6
"Car Illustrated"	1	1	0
Carless, Capel and Leonard	1	1	0
Carlton Studio	1	1	0
Carlyle, Chirm & Co.	1	0	0
Carr, A. L. F.	0	10	6
Carrs (Saltley), Ltd.	0	10	6
Carter, J., & Co.	0	10	6
Cartwright, J. P.	1	1	0
Cash, F. T.	1	1	0
Cash, H. J., & Co.	1	0	0
Caslake & Co.	10	10	0
Casperd, H. A.	0	10	6
Castle Rubber Co.	0	10	0
Cattell, C. S.	1	1	0
Chamen, R. A.	1	1	0
Chance, W. E., & Co.	5	5	0
Chaplin, S. H.	0	10	6
Chapman, F. M.	2	2	0
Chapman, Mrs. F. M.	1	1	0
Cheiloti, G.	1	1	0
Childe, E. A.	10	10	0
Chloride Elec. Storage Co	3	3	0
Churchill & Co., Ltd.	1	1	0
Chutter, L.	0	5	0
City Glass Co.	0	5	0
Clayton, A. J.	1	1	0
Cleave & Co.	0	10	6
Clement, J.	1	1	0
Cleveland Iron Co.	2	2	0
Clifton & Kersley Coal Co.	0	10	0
Clouth, E., & Co.	4	4	0
Coates, H. J.	1	1	0
Cochrane, A. R.	1	0	0
Collings, J. H.	1	1	0
Colson, Thomas	5	0	0
Concordia Elec. Wire Co.	5	5	0
Conley Foil Co.	1	1	0
"Contractors' Record"	1	1	0
Cook, Edward, & Co.	0	10	6
Cook, F. W.	0	10	6
Cooper & Goode	1	1	0
Cooper, C.	0	10	0
Coote, E.	0	10	6
Cottis, W., & Sons	1	1	0
Courtenay, A. R.	0	10	6
Coveney, E.	1	1	0
Cowan, C. R.	0	10	0
Coward, Philipson & Co.	2	0	0
Cox, W.	2	2	0
Craig, K. C.	0	10	6
Craig, L.	0	10	0
Cramb, Alexander	1	1	0
Crampton & Co.	2	2	0
Crawford, F.	1	10	0
Crawshaw & Sons	1	1	0
Cresswells, Ltd.	1	1	0
Croal Spinning, Ltd.	1	1	0
Crowley & Sons	0	5	0
Cruickshanks, R., and Co.	0	10	6
Crypto Electrical Co.	2	2	0
Crystalate Mfg. Co.	2	2	0
Curtis Manufacturing Co.	1	1	0
Curtis, W.	1	1	0
"Daily Chronicle"	5	5	0
"Daily Express"	1	1	0
"Daily Telegraph"	10	10	0
Dark, M. S.	0	10	6
Dashwood, E. S.	1	0	0
Davidson, C. S.	1	1	0
Davis & Timmins	5	5	0
Davis, A. R., & Co.	0	10	0
Davis, H. M.	2	2	0
Davis, S.	1	1	0
Dawson, J., & Son	1	1	0
Dawson, Philip	2	2	0
Deeley, J. H.	0	10	0
De Garrs & Allen, Ltd.	5	5	0
Dennis, R.	0	5	0
Dernier, Louis, & Co.	5	5	0
Deverill, A. G.	0	10	0
Dixon (Walter) & Co., Ltd.	2	2	0
Docker Bros.	1	1	0
Dockrell, Thos., and Sons	0	10	6
Dodimead, A. E.	2	2	0
Donnison, Sillem, and Co.	1	1	0
Dornier & Co.	2	2	0
Doulton & Co.	2	2	0
D. P. Battery Co.	1	1	0
"Drapers Record"	1	1	0
Dray, G. W., & Sons	0	5	0
Drennan, Glover, and Cooper	1	1	0
Drury Bros.	0	10	0
Duckitt, T.	0	10	6
Du Cros, W. & G., Ltd.	1	1	0
Duncan Watson & Co.	2	2	0
Durran, J., & Sons	0	10	0
Dussek Bitumen Co.	0	10	6
Dutilh, D. A., & Co.	1	0	0
Dyer & Young	1	1	0
Earle, Bourne, & Co.	0	10	0
"Eastern Daily Press"	0	10	6
Eaton, A.	0	10	6
Ebonestos Mfg. Co.	0	10	6
Eckstein & Heap	5	5	0
Edey, F. G., & Co.	1	1	0
Edwards & Barnes	2	2	0
Edwards, G. W.	1	0	0
Edwards, R. A. S.	1	0	0
"Electrical Industries"	0	10	6
Electrical Installations, Ltd.	1	1	0
Electrical Press	2	2	0
Electric Battery Co.	0	10	0
Electric Control, Ltd.	1	1	0
"Electrical Times"	5	5	0
"Electrical World"	1	1	0
"Electrician" Printing & Publishing Co.	2	2	0
Ellermann City Lines	2	2	0
Elliott Metal Co.	1	1	0
Ellis, Simpson and Saunders	10	0	0
Ely, N. W.	1	1	0
Emery Bros.	1	1	0
"Engineering," Ltd.	1	1	0
Engineers' Standard Catalogue	2	2	0
Escombe, McGrath & Co.	1	1	0
Essex Accumulator Co.	3	3	0
Espir, Ferdinand	1	1	0
Evans, J. Wesley	0	10	6
Evans, W. E.	0	5	0
Everitt & Co.	5	5	0
Evershed, W.	0	10	6
Evershed, W. J.	0	10	6
Export Dept.'s Staff, G.E.C.	0	17	0
Facsimile Letter Printing Co.	1	1	0
Fairclough, T. M., and Co.	2	2	0
Falshaw, R.	3	3	0
Farthing, J. H	1	1	0
Feld Bros.	3	3	0
Felten & Guilleaume	10	10	0
Fenestre, Cadisch & Co.	1	1	0
"Financial News"	5	5	0
"Financier," The	0	10	6
Fisher Renwick, Ltd.	0	5	0
Fisher, W. C.	1	1	0
Flaxman, A. E.	0	5	0
Fleming, J., & Co.	1	1	0
Fletcher, E. W.	1	0	0
Fletcher, H.	0	5	0
Fletcher, J. Y.	2	2	0
Flower, J. B.	0	5	0
Foot & Milne, Ltd.	1	0	0
Ford, Ltd.	1	1	0
Forman, Thomas, and Sons	1	1	0
Foster, J. R., & Co.	1	1	0
Fothergill, A. E. (Reader & Sons)	1	1	0
Fox, T.	2	0	0
France, W. M.	1	1	0
Francis, W.	0	10	6
Franklin Co., The	0	5	0
Fraser, G. R.	2	2	0
Fraser, J.	2	2	0
Frederick Crane Chemical Co.	1	1	0
Freeman, A.	0	5	0
Fry, Claud	1	1	0
Gamage, A. W., and Co.	1	1	0
Gaskell & Grocott	1	1	0
Garcke, E.	100	0	0
Gardner, J.	0	10	6
Garrard, Dr.	2	0	0
Gay Bros.	0	5	0
Gee & Watson	0	5	0
Geipel & Co.	1	1	0
Gem, H. A. & G. P.	1	1	0
General Electric Co.	100	0	0
General Transport Co.	0	10	6
Gentry, S.	0	10	6
Gerstle, S.	1	1	0
Gibbons, B., & Sons	0	10	0
Gilbertson, H.	0	5	0
Gilkes, J. C.	0	5	0
Gill, A. B.	10	10	0
Gill, W.	0	10	6
Gillman, J., & Sons	1	1	0
Gilson, C. J., & Co.	2	2	0
Gilson, D., & Co.	2	2	0
Girdlestone & Co.	0	10	6
Glanmor Foundry Co.	0	10	6
"Glasgow Herald"	1	1	0
Godrich, A. E., & Co.	1	1	0
Goldsmith, E.	0	10	6
Goligher & Smith	2	2	0
Goodwin, J. A.	0	5	0
Goodyear, S., & Sons	0	7	6
Gorham, J. M.	1	1	0
Gosling, A. S.	0	10	6
Graham, Alfred, & Co.	2	2	0
Grainger, T. J.	1	1	0
Granville Electro-Plating Co.	1	1	0
Gray, J. Hunter	5	5	0
Gray, John	5	5	0
Greaves, T. W.	0	10	6
Green, F., & Son	0	10	6
Green, F., & Sons	0	10	6
Green, J. C.	0	5	0
Greenwood, L. A.	0	5	0
Grevener, J. & H.	3	3	0
Griffith, J. W.	0	10	0
Griffiths Bros. & Co.	2	2	0
Grigsby, B. J.	1	1	0
Grigsby, P.	1	1	0
Groom, H. R. L.	0	10	0
Grothe & Sons	1	0	0
Grove, Edward	0	10	6
Gullet, W.	0	5	0
Gunn, N.	1	1	0
Gunn, Thomas, Ltd.	2	2	0
Gunner, C. E.	0	5	0
Gunzburg, R.	20	0	0
Gunzel & Rosenberger	0	10	6
H. B.	0	10	6
Haddock & Parker, Ltd.	2	2	0
Hadley, A.	0	10	0
Hagen, Jonas, & Co.	0	10	6
Hague, H. B.	1	1	0
Hague, H. B., & Co.	0	10	6
Haken, C. E.	0	10	6
Hale, F. H.	0	10	6
Hall & Pickles, Ltd.	1	1	0
Hall, J., & Co.	2	2	0
Hamburger, A.	1	1	0
Handford, F.	0	5	0
Hann, E. W.	1	1	0
Hanson, Brown, & Co.	0	10	6
Hardman, C. A.	0	10	6
Hardware Trade Journal"	1	1	0
Hardy, J. North	1	1	0
Harper, W., Son, & Co.	0	10	0
Harriman, S.	1	1	0
Harrison, H.	0	10	6
Harris, A. E., & Co.	1	1	0
Hatton, Charles & Co.	0	10	6
Hawkins, A., & Sons	0	10	0
Hawkins & Sons	0	5	0
Head, Henry, & Co.	2	2	0
Heath, W. G.	1	1	0
Heaton, W. H.	1	5	0
Hecht, Levis & Kahn	1	1	0
Heckford, A. E., & Co.	0	10	6
Heilbut, Symons & Co.	5	5	0
Helbing & Passmore	10	10	0
Henderson, George	10	10	0
Henderson & Walker	1	1	0
Hernu, Peron & Co.	1	1	0
Herve, L.	9	9	0
Heward, S. Barclay	5	0	0
Hewitt Bros.	1	1	0
Hicks, H.	1	1	0
Hicks, H. B.	0	2	6
Higson, J.	1	1	0
Hill, Craven & Hay	1	1	0
Hill — (Moberley and Perry)	3	3	0
Hill, W. W., Sons, and Wallace, Ltd.	1	1	0
Hillebrant, J. J. H.	10	0	0
Hills, W., & Co.	3	2	0
Hinton & Brockington	1	1	0
Hipkiss, W.	1	1	0
Hirst, Hugo	100	0	0
Hitzelberger, G.	1	1	0
Hobart, Bird & Co.	1	1	0
Hodge, F. Parvin	0	10	6
Hodgetts, T.	0	10	0
Hodgson, Francis	0	5	0
Holden, A., & Sons	0	10	6
Holgate & Cummin	1	1	0
Holgarth, G.	2	2	0
Holliday, P.	0	5	0
Hollidge, W. J.	1	1	0
Hollings & Guest	2	2	0
Holloway Bros.	5	5	0
Holmes, H. H.	1	1	0
Holmes, W. H. & Sons	1	1	0
Holophane, Ltd.	2	2	0
Holt, L. C.	1	1	0
Holzingger, M.	0	5	0
Holzner, M.	0	5	0
Hood, J. E.	2	2	0
Hook, C. M.	1	1	0
Horsfall, L.	0	10	6
Hopyard Foundries, Ltd.	1	1	0
Houlder Bros., Ltd.	2	2	0
Howitt, Dr. Grahamsley	1	1	0
Hudson & Sons	1	1	0
Hughes, J. H.	1	1	0
Hughes, J. & J.	1	1	0
Hughes Stubbs Metal Co.	2	2	0
Hunt, F.	0	10	0
Hunt, J. A. H.	1	1	0
Hurburgh, L. H.	3	3	0
Huth, Fredk., & Co.	5	5	0
Hyde, J. B., & Co.	5	5	0
Ickelheimer, Max	2	0	0
Ide, A. E.	1	1	0
Ide, G. H.	5	5	0
Igranic Electric Co.	5	5	0
"Illustrated London News"	2	2	0
"Illustrated Sporting & Dramatic News"	1	1	0
Imhoff & Lange	1	1	0
Industrial Waste Eliminators	1	1	0
Ingram, J. G., & Sons	1	1	0
"Investors Guardian"	1	1	0
Ireland, A. J.	1	1	0
"Ironmonger, The"	2	2	0
Jackson & Boyce	0	10	6
Jacob & Valentin	1	1	0
Jacobs, H.	0	5	0
James, H. V.	1	1	0
Jaroslaw, D.	2	2	0
Jeffcoat, C. H.	0	10	6
Jenkins & Son	0	5	0
Jenks, A. E., & Cattel	1	1	0
Jepson, A. E.	0	7	6
Jessop, J. F.	0	10	6
Jeynes, A., & Sons	1	0	0
Johnsen & Jorgensen	10	10	0
Johnson & Phillips, Ltd.	10	10	0
Johnson, Clapham, & Morris	1	1	0
Johnson, Matthey & Co.	5	5	0
Johnson Iron & Steel Co.	1	1	0
Jones, B.	1	1	0
Jones Bros.	1	1	0
Jones, C. W.	1	1	0
Jones, G. R. & Co.	0	10	6
Jones, Manley, & Co.	1	1	0
Jones, Price, & Co.	0	10	6
Joseph, W.	0	5	0
Joyce, E. A.	0	5	0
Joyce, Mrs. E. A.	0	5	0
Juniper, C.	0	5	0
Juttke, Dr.	1	1	0
Kahl, A. R.	1	1	0
Kahn, Dr.	0	10	6
Kahn, H.	1	1	0
Karteret Engineering Co.	0	7	6
Kamnitz & Uhlig	1	0	0
Kempton, C., & Sons	2	2	0
Kenney & Co.	0	10	6
Kensington Stamping Co.	10	10	0
Kerr-Jones, T.	0	10	6
Key & Whiting, Ltd.	1	1	0
Kidd, J., & Co.	1	1	0
Killick, Martin & Co.	1	1	0
Klingenstein, W., & Co.	1	1	0
Kipping, P. P.	3	3	0
Kloster, Veitsdorf	1	9	3
Knight, C. J.	0	10	6
Knight, C. S.	0	10	6
Koettgen, C.	5	5	0
Kramer, H. von	1	1	0
Krasa, F., & Co.	1	1	0
Kratscher, H.	1	0	0
Krause, A.	1	1	0
Krausse & Auerbach	1	1	0
Krojanker, J. (Lowenstein & Hecht)	10	10	0
Krupka & Jacoby	1	1	0
Lacey, J.	0	10	0
Lake, S.	0	5	0
Land, S. T.	0	5	0
Langbein Pfanhauser Works	0	10	0
Langdon, C.	0	10	6
Langford, O. C.	0	10	6
Larmouth, T., & Co.	5	5	0
Lawden & Poole	0	5	0
Lawrie & Bishop	1	1	0

	£	s.	d.
Lawton, M. (Albion Clay Co.)	2	2	0
Lee & Hunt	1	0	0
Lees, J. B. & S.	2	2	0
Lehmann Bros.	1	1	0
Lench, T. W., Ltd.	2	2	0
Leo, W. A.	0	10	6
Les Fils de Isidoro Kisch	0	8	6
Levinger, M.	2	2	0
Lewis, Thomas, Ltd.	1	1	0
Liebmann, Adolf, Dr.	10	10	0
Linde British Refrigeration Co.	5	5	0
Lines, John	1	1	0
Lister, George	0	10	6
Litholite, Ltd.	1	1	0
Lloyd, R., & Co.	1	1	0
"Local Government Journal"	1	1	0
Locke, W. J.	0	10	6
London Elec. Supply Co.	2	2	0
London Elec. Wire Co. and Smiths, Ltd.	3	3	0
"London Opinion"	1	1	0
London Sand Blast Decorative Glass Works	1	1	0
London Parcels Delivery Co.	1	1	0
Lord, F. A. B.	5	5	0
Lord & Shand	1	1	0
Lucas, J., & Co.	3	3	0
Lunge, E.	2	2	0
MacGowan, Wild, & Co.	0	10	6
McGregor, Gow, Norris, & Joyner	2	2	0
Macintyre, Jas., & Co.	2	2	0
McKechnies, Ltd.	1	1	0
Mackintosh, Charles, & Co., Ltd.	1	1	0
Maldon, J. C.	0	5	0
Maling, C. T., & Sons	1	1	0
Mallandain, A. E.	1	1	0
Manchester Bill Posting Co.	3	3	0
Marelli, Ercole, & Co.	5	5	0
Marr, J. B., & Co.	0	10	6
Marshall Engraving Co.	0	5	0
Marsh Bros.	0	10	0
Martin, W. C., & Co.	0	10	6
Martin & Clarke	0	10	0
Martin, W. Winn, & Co.	1	1	0
Maskowski, P.	1	1	0
Mason, James & Co.	1	1	0
Matthews, E., & Co.	0	10	0
Maurice, G.	2	2	0
Mavor & Coulson, Ltd.	5	5	0
Maxwell, Butcher, & Co.	0	10	6
May, W. J.	0	5	0
Mayer, S.	1	1	0
Mead, W.	1	0	0
Meaby, W.	3	3	0
Meek, Thomas, & Co.	0	10	6
Mehne, J. & G.	2	0	0
Meirowsky, A. G., & Co.	2	2	0
Mercer, J.	1	1	0
Mercer, J.	0	10	0
Merton, Hy., & Co.	10	10	0
Meyer, A., & Co.	5	5	0
Micanite & Insulator Co.	1	1	0
Middleton, V. G.	1	1	0
Midland Ironworks, Ltd.	1	1	0
Miller, W. C., & Co.	1	1	0
Mitchell, H. E.	0	10	0
Mitchell, J. & W.	2	2	0
Mitrovitch Bros.	2	0	0
Mittelhausen, Mrs.	1	1	0
Mole & Sons	1	1	0
Molineaux, Webb & Co.	0	10	0
Mond, E. S.	1	1	0
Money, F.	1	1	0
Moore, A., & Co.	5	5	0
Morgan, A. F.	1	1	0
Morgan, E.	0	5	0
Morgan, G.	1	1	0
Morgan, J.	0	5	0
Morgan Crucible Co.	5	5	0
Morgan, Reeve, & Co.'s Staff	0	17	3
Morret, Victor	0	7	11
Morris & Morris	1	1	0
Morris, W., & Sons, Ltd.	2	2	0
Morton Bros.	0	10	0
Morton (Francis) & Co.	1	1	0
Mosses & Mitchell	1	1	0
Mottet, V.	0	5	0
Mould, J. T.	0	10	6
Mueller, F. R., & Co.	1	1	0
Mullock, W.	1	1	0
Multiplex Advertising Machine Co.	2	2	0
Munzing, H., Ltd.	0	10	6
Murray, J. O'Hara	3	3	0
Myers, Leo. M.	1	1	0
Nash, H.	0	10	6
National Gas Engine Co.	1	1	0
"Nemo"	0	5	0
New, M.	2	2	0
New British Elec. Supply Co.	1	1	0
New British Ever-Ready Co.	5	5	0
Newberry, G.	0	5	0
Newby & Sons	2	2	0
New Eccles Rubber Co.	0	10	6
Newgass, B.	10	10	0
Newgass, B., & Co.	5	5	0
Newgass, Edgar	0	15	0
Newnes, George, Ltd.	2	2	0
Newport Enamel Plate Co.	0	10	6
Newton & Co.	0	10	6
New York and Hamburg Rubber Co.	1	10	6
Nicholls, M. N.	0	5	0
Nicholson, C. S.	2	2	0
Nield, F. A.	0	5	0
Nielson, J. F.	1	0	0
Nippon Yusen Kaisa	1	1	0
Noble, W.	1	1	0
Noble, W. McD.	0	5	0
North-Eastern Novelties Co.	0	10	6
Northern Elec. Wire Co.	2	2	0
Northern Mfg. Co.	0	10	6
Norton & Gregory, Ltd.	0	5	0
Nugent, P. H.	1	0	0
Oberlander, Otto, Dr.	10	10	0
Ochie, Albert	0	10	6
Odhams, J. & G.	0	10	6
Oliver Arc Lamp Co.	0	10	0
Oliver, P.	0	10	0
Opel Motors, Ltd.	1	1	0
Oriental Tube Works	1	1	0
Orsettich, R.	2	2	0
Ormiston, P., & Sons	5	5	0
Osborne, Samuel, & Co.	0	10	6
Osborn & Hunter	0	10	6
Osram Lamp Works	100	0	0
Owbridge & Co.	1	1	0
Page & Miles, Ltd.	2	2	0
Page, W. L.	0	5	0
Pakenham, W. L.	1	1	0
Palmer, H. Clifford	2	2	0
Palmer, W. H., & Co.	1	1	0
Paris, E. A.	5	0	0
Parish, Thomas, & Son	0	10	6
Parker, F., & Co.	1	0	0
Parkhall Pottery Co.	1	1	0
Parshall, H. F.	2	2	0
Parsons, G.	1	1	0
Partridge & Sons	0	5	0
Paterson, W.	0	5	0
Peare, W. F.	0	5	0
Peel-Conner Telephone Works	21	0	0
Peglar, C.	0	10	0
Pender, Sir James	1	1	0
Perian, H. W.	1	1	0
Perlbach, H. J., & Co.	1	1	0
Perrin, W.	0	10	6
Peter, Brotherhood, Ltd.	1	1	0
Phelp, J. A.	3	3	0
Phosphor Bronze Co.	1	1	0
Pilditch, G. F.	0	10	6
Pinchbeck Bros.	1	1	0
Pinchin, Johnson & Co.	4	4	0
Pinna, H. de, & John Venn	2	2	0
Pirelli & Co. (Milan)	20	0	0
Pirelli, Ltd.	2	2	0
Pitman, M.	0	10	6
Pitt, G. H.	0	10	6
Pitt, H. S., & Co.	1	1	0
Planchon, F. J.	6	0	0
Plutte, F.	3	3	0
Plutte, Scheele & Co.	1	1	0
Pohl, G.	1	1	0
Pooley, H., & Sons	1	1	0
Pope, H. P., Ltd.	1	1	0
Porte, F. C.	3	3	0
Potter, E. H.	0	10	0
Poulter, R. C. M.	1	1	0
P. Q. Cable Co.	1	1	0
Preece, L.	0	10	0
Preston, A.	1	0	0
Price, S. L.	0	10	6
Price, Waterhouse & Co.	1	1	0
Priestman, T. G.	0	5	0
Priestman, T. J.	0	10	6
Proctor, C. F.	0	10	0
Pugh, E., & Co.	1	1	0
Putzler Bros.	2	10	0
Pyne, H. B.	1	1	0
Quitman, C.	1	1	0
Railing, Dr. A. H.	20	0	0
Raling, M. J.	40	0	0
Ranken, A. W.	0	10	0
Rauschert, C. P.	3	0	0
Rauschert Porcelain Works, The Paul	3	0	0
Rayner, O.	0	5	0
Record, O. L.	0	5	0
Reed, H. M.	0	10	6
Rennie, J. T., & Sons	1	1	0
Renton & Co.	1	1	0
Renwick, H. B.	1	1	0
Reynolds, J., & Sons	0	10	6
Richardson, C., & Son	1	1	0
Richardson, H. G., & Sons	1	1	0
Richardson, J.	2	2	0
Riches, W. R.	0	10	0
Richford, E. M., & Co.	1	1	0
Riddle, Smith & Duffus, Ltd.	2	2	0
Ridout, F.	1	1	0
Riech, S., & Co.	1	1	0
Rigby, R.	1	1	0
Rigby, T.	0	5	0
Rigby, W. H.	0	5	0
Riley, Thomas	0	10	6
Risch, F.	1	1	0
River, S.	0	7	6
Robb, W.	0	10	6
Robins and Felt	1	1	0
Roberts, H. Wynne	1	1	0
Roberts, William, & Son	2	2	0
Robertshaw, J., & Sons	1	1	0
Robertson Elec. Lamp Works	21	0	0
Robertson, R. (Dobson, Molle & Co.)	2	2	0
Robertson, W. B.	0	5	0
Robinson, J. & T.	0	10	6
Robinson, R. E.	1	1	0
Robson, C. H.	0	10	6
Robson, J. W.	0	5	0
Rock, A. F.	1	1	0
Rogers, H.	0	10	6
Roneo, Ltd.	1	1	0
Rook, J. W.	2	2	0
Round, A.	0	10	6
Royle, W. R., & Sons	2	2	0
Rubery, Owen & Co.	1	1	0
Rudders & Paynes	1	1	0
Ruddle, M.	0	10	6
Rudenberg, E.	1	1	0
Russ, S. C.	1	1	0
Russell, L., & Co.	0	10	6
Ryland's Glass & Eng. Co.	2	2	0
Rylands, L., Ltd.	0	10	0
S. B. W.	1	1	0
St. James & Pall Mall Elec. Lighting Co.	5	5	0
Sale, D.	0	5	0
Salomons, Sir David	100	0	0
Samuelson, F.	3	3	0
Sanders, Thomas, Ltd.	2	2	0
Sanders, William	1	1	0
Sands, O.	0	10	0
Sankey, J., & Sons	5	5	0
Schenker & Co.	1	1	0
Schmidt, Conrad W., Ltd.	0	10	6
Schultz & Co.	1	1	0
Schultz, E. (Loewenstein & Hecht)	5	0	0
Schwabe, Franz, & Co.	5	0	0
"Scotsman"	0	10	6
Scott, G. M.	1	1	0
Scott, J. W.	0	5	0
Scrivener, J.	0	5	0
Scupham & Wood, Ltd.	1	1	0
Seabrook, A. Hugh	1	1	0
Selinger, S.	1	0	0
Sells, Charles	1	1	0
Sells, F. S.	20	0	0
Sergeant, Longstaff, & Co.	1	1	0
Shannon, Ltd.	1	1	0
Shepherd, Swine & Markham	1	0	6
"Ship Building and Shippers' Record"	2	2	0
Shrimpton, G., & Sons	0	5	0
Shrimpton, George, & Sons	1	1	0
Siddaway, E.	0	10	0
Siddons, J. & J.	1	1	0
Simon, A.	1	0	0
Simon, H. F.	1	1	0
Simpson, Alfred, Ltd.	1	1	0
Simpson, C. L.	1	1	0
Sims, P. J.	3	3	0
Sinclair, D.	0	10	0
Sinnott, J.	0	7	6
Sisson, W., & Co.	1	1	0
Smallman & Sons	1	1	0
Smith, F., & Co.	1	1	0
Smith, J. Archer	1	11	6
Smith, R. Wilson	2	2	0
Smith, Thomas	1	1	0
Snell (Albion) & Partners	1	1	0
Snowden, W. H.	0	5	0
Spence, J.	1	1	0
Spicer Bros.	1	1	0
Spicer, T. D.	0	10	0
Staff of Publication Dept. (G.E.C.)	0	12	0
"Standard, The"	5	5	0
Stearn Electric Lamp Co.	1	1	0
Stearn, Frederick & Co.	2	2	0
Steel Barrel Co.	2	2	0
Steel Conduit Co.	2	2	0
Steinbach & Hohn	3	0	0
Stevens & Williams	5	5	0
Stiles, T. P.	1	1	0
Still & Co., M. C.	1	1	0
Stinton, H. O.	0	10	6
Stolbenberg Patent File Co.	1	1	0
Storey, W.	0	5	0
Strachan, J.	1	1	0
Stranack, H. E.	0	5	0
Stothert & Pitt	1	1	0
Stuart, K. R.	0	10	6
"Sunday Times"	1	1	0
Sutro, L., & Co.	2	2	0
Sutton & Co.	1	1	0
Swift, Levick & Sons	1	1	0
Swinburne, James	1	1	0
Swinton, A. A. C.	5	5	0
Swiss Bankverein	2	2	0
Symington, W., & Co.	2	2	0
"Sympathiser"	0	5	0
Tannahill & Co.	1	1	0
Taylor, A. L.	1	1	0
Taylor, C.	1	0	0
Taylor, J. A., & Sons	0	10	6
Taylor, S., and Co.	0	10	6
Taylor, T.	1	1	0
Taylor, Tunnicliff & Co.	6	6	0
Terry & Co., Ltd.	2	2	0
Terry, H., & Sons, Ltd.	0	10	6
Thames Paper Mills Co.	5	0	0
Thom & Cook	2	2	0
Thomas, J.	0	5	0
Thompson, H. F.	0	5	0
Thornhill & Cowley	0	5	0
Thornley, Samuel, & Co.	5	0	0
Todd, J., & Sons	0	10	0
Touche, G. A., & Sons	2	2	0
Townshend, Bros.	0	10	0
Traun, H., & Sons	1	1	0
Trefileries et Laminoirs du Havre	10	10	0
Treherne, J., & Sons	0	10	6
Trezise, J. N. C.	0	10	6
Trippe, C. F.	0	10	0
Tubbs, Franklin	1	1	0
Tufnell, C. F.	1	1	0
Tullis, J., & Sons	1	1	0
Turner Aspirator Co.	0	6	0
Turten, J. A.	0	10	6
Ullman, J., & Co.	1	1	0
Underwood Typewriter Co.	1	1	0
Ungley, Edwin	0	10	0
Union Castle Mail Steam Ship Co.	2	2	0
United Flexible Metallic Tubing Co.	0	10	6
Unsworth, A., & Co.	2	2	0
Utting, J. W.	1	1	0
Varley Magnet Co.	0	10	0
Vaughan, Edgar, & Co.	1	0	0
Vaus & Crampton	0	10	6
Vickery, George	10	10	0
Vitrite Works, Ltd.	5	5	0
Wakefield & Sons	1	1	0
Walker Bros. (London), Ltd.	1	1	0
Wallis, A. L.	1	1	0
Walpole Rubber Co.	2	0	0
Walsham, Ltd.	0	5	0
Walter, A. J.	5	5	0
Wansborough, Skelsey & Cooper	0	10	6
Wares, O. S.	0	12	0
Warneker, G. H.	0	10	6
Warneker, J.	0	10	6
Warnoch, G. W.	0	10	6
Watson, S. J.	0	10	6
Waygood, R., & Co.	2	2	0
Weaver, C. A.	2	2	0
Weaver, R. B.	2	2	0
Webster & Bennett, Ltd.	1	1	0
Weeks, G., & Sons	1	1	0
Weir, G. & J., & Co.	1	1	0
Weiss & Biheller	1	1	0
Welsbach Light Co.	2	2	0
Wesson, A. E.	0	5	0
West, E.	1	1	0
West End Engraving Co.	0	10	6
Wheatley, G. W., & Co.	1	1	0
W. H. H.	5	0	0
Whillon, T.	0	5	0
Whipp & Bourne	1	1	0
"Whitby Gazette"	0	5	0
White, S. D.	2	2	0
White, William, & Co.	5	5	0
White, W. S.	0	10	0
Whiteley, W., & Co.	0	10	6
Whitfield, H., & Co.	1	1	0
Whitfield, H., & Co.	2	2	0
Whittall, F. G.	1	1	0
White & Pyke	2	12	6
Wiggin, H., & Co.	5	5	0
Wilcox, F. W.	0	10	0
Wild & Collins	2	2	0
Wiles, E. P., & Co.	1	1	0
Wilfore, P. H.	0	5	0
Wilkins & Wright	10	10	0
Wilkins, John, & Co. (London)	5	5	0
Wilkins Wire Rope Co.	0	10	6
Wilkinson, H. D.	2	2	0
Wilkinson, J.	1	1	0
Wilkinson, J., & Sons	1	1	0
Willcox & Gibb	0	5	0
Willey, W. H., (London Elec. Wire Co.)	1	1	0
Williams, F.	0	10	6
Williams, Howard	1	1	0
Willis & Bates	2	2	0
Wilmhurst, J. J.	1	1	0
Wilson, C.	2	2	0
Wilson, E.	1	1	0
Wilson, J. W.	0	5	0
Winn, Charles, & Co.	1	1	0
Winser, E.	0	7	6
Winship, R. R.	0	5	0
Winter, F. G.	2	2	0
Wiseman, Alfred, & Co.	1	1	0
Witton Carbon Works' Staff	2	12	0
Wittusen, H., & Co.	2	2	0
Wolf, S., & Co.	1	1	0
Wood, W. W.	1	1	0
Wood & Kendrick	1	1	0
Woodbridge, S.	1	1	0
Woodhouse & Rixson	2	2	0
Woods, M. W.	1	1	0
Wollett, Airey & Co.	1	1	0
Workman, G.	0	10	6
Worsnop & Co.	3	3	0
Wright's Forge & Eng. Co.	2	2	0
Wrigley, E. G., & Co.	2	2	0
Wylie, F., & Co.	0	5	0
Yates, J. R.	2	2	0
Yorkshire Cable Co.	1	1	0
Yorkshire Copper Works	1	1	0
Young, G.	0	10	6
Zettel, Dr. T.	2	2	0

Sundries.—Amounts of less than 5s. collected per:—

			£	s.	d.
Collection Box			0	16	2
"	"		0	4	2
Book	65		1	11	0
"	69		1	3	3
"	70		0	12	6
"	75		1	6	7
"	83		0	8	6
"	84		1	11	6
"	85		0	1	0
"	90		0	5	0
"	91		0	16	6
"	92		1	13	0
"	97		1	11	9
"	98		2	0	4
"	102		1	1	0
Card	3		0	12	6
"	4		0	12	6
"	5		0	8	0
Card	6		1	9	6
"	16		0	13	9
"	23		0	12	0
"	24		0	7	6
"	25		0	2	0
"	27		0	5	6
"	28		0	5	0
"	29		0	19	6
"	30		0	15	6
"	31		0	2	6
"	32		0	12	6
"	33		0	7	6
"	34		0	9	6
"	35		0	5	9
"	36		0	7	0
"	37		0	7	6
"	39		0	12	6
"	40		0	10	0
"	41		0	3	6
"	42		0	7	6
"	43		0	7	6
"	44		1	1	0
"	45		0	7	6
"	52, 53		1	2	6
"	59		0	6	6
"	60		0	17	0
"	64		1	6	0
"	65		0	14	3
"	75		0	4	0
"	77, 78		0	12	6
"	83		0	2	6
"	88		0	12	6
"	90		0	8	0
"	91		0	2	6
"	92		0	5	0
"	93		0	14	0
"	94		0	7	0
"	95		0	17	6
"	96		1	11	6
"	97		0	14	6
"	98		0	2	6
"	99		0	10	0
"	100 and 367		0	18	0
"	101		0	5	0
"	103		0	5	9
"	104		0	19	0
"	107		0	4	0
"	128		0	16	6
"	129		0	13	3
"	130		0	15	6
"	131		0	5	0
"	132		0	3	9
"	133		0	5	0
"	145		0	13	6
"	146		5	5	0
"	155		0	18	0
"	157		0	16	6
"	159		0	8	3
"	160		0	12	0
"	161		0	13	6
"	167 and 369		2	7	0
"	168		0	18	0
"	169		1	7	6
"	170		1	10	3
"	178		0	19	3
"	186		0	12	6
"	187		0	19	6
"	191		0	19	0
"	195		0	8	6
"	206		2	1	0
"	207		0	1	0
"	209		1	11	1
"	210-11		0	4	0
"	212		0	3	0
"	213		0	19	0
"	214		0	3	0
"	215		0	10	0
"	216		1	18	6
"	219		1	6	6
"	224		0	13	6
"	224-235		3	12	6
"	238		4	4	0
"	240		0	8	0
"	241		0	5	6
"	242		0	9	0
"	248		1	13	0
"	256		4	5	0
"	257		0	8	6
"	258		0	5	3
"	259		0	7	6
"	260		0	3	0
"	261		0	17	0
"	262		0	14	1
"	264		0	6	8
"	265		1	16	4
"	266		1	2	6
"	267		0	16	2
"	268		0	19	7
"	269		0	10	0
"	271		0	10	6
"	274		0	5	0
"	275		0	3	9
"	278		0	17	0
"	281		4	1	6
"	288		0	14	6
"	296-304		1	17	6
"	312		0	7	0
"	322		0	5	0
"	323		0	4	6
"	324		0	5	0
"	325		0	14	6
"	326		0	11	0
"	327		0	17	6
"	328		0	9	6
"	329		0	4	6
"	331		1	1	6
"	346		0	2	0
"	347		0	12	0
"	348		1	5	6
"	366		1	9	0
"	367		1	1	6
"	368		1	9	3
"	372		0	15	0
"	400		0	12	0
"	408		0	9	0
"	410		0	6	0
"	411		0	2	6
"	412		0	10	6

£2,463 15 1

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Modern Motor.

As another workman who has had considerable experience in the maintenance of ancient and modern motors, I have been very much interested in Mr. E. F. Butler's article and Mr. Henry Fowler's letter.

Mr. Fowler's remarks remind one of the story about the editor of *Punch* who, on being told that his paper was not as good as it used to be, replied "No! it never was."

If Mr. Fowler is so pleased with the "old makes" that run so well, perhaps he will tell us why he has had "the pleasure (?) of taking out many of these old armatures."

In the good old days machines frequently did not carry such heavy loads in relation to their H.P. as they do to-day, and the life of a motor should be judged by the work it does and not by the time it takes to do it.

To-day we have machines that will run without sparking from no load to overload with a fixed brush position.

"Thick" commutators were necessary in the days of copper brushes—would Mr. Fowler like to see these back? they were indeed "rare sights," but where is the necessity for a heavy commutator to-day, there being practically no wear if it is properly looked after?

I quite agree with Mr. Fowler *re* the Crocker-Wheeler brush gear being a good type to use.

Practically all the old motors were of the open type; to-day motors are either semi or totally enclosed. This makes a great difference to their "get-at-ableness."

Where the box type of brush-holder is used, it would be advisable to insulate the tension spring from the brush. One or two makers are trying to do this by inserting fibre between the spring and brush, depending upon the flex for the carrying of the current, and thus preventing the overheating and consequent loss of tension of the spring.

The articles of Mr. Butler are most useful, and so was the recent correspondence on interpole motors.

Hoping that you will publish more of this class of article for the benefit of the maintenance men.

L. Seno.

With reference to Mr. Henry Fowler's letter in last week's issue, he appears to have been more fortunate with the older machines than I have, although a number of them worked, and are still working, very well, and will continue to work when some of the modern ones are on the scrap heap. I know of an old Gramme machine which has been in use continually for over 30 years, and still runs all day. I cannot share his enthusiasm for the early American motors with their wooden brush rockers, holders without any adjustment for tension, and no pigtails to the brushes. Breakdowns were numerous, due to the insulation of the windings only being suitable to the drier and hotter climate of America.

He also states that motors are not built now for rough handling or for taking adrift easily. The latter is true enough. No designer appears to think that a motor is ever likely to break down or even require cleaning, but ability to stand rough handling is where the modern motor does score. The older machines would not stand up to the conditions met with in a steel works or colliery, nor yet meet the demands of reversing motor planers or gear-driven machine tools with a speed variation of 3 to 1. As the result of experience, improved design and the better utilisation of material, the better present-day makers have reduced both weight and cost for the same output.

With regard to his statements on flashing over, of course any machine will flash over if the brushes are rocked far enough into the wrong position. This, however, is not due to faulty design but improper operation. I have seen the machines referred to in my article flash over with half load or even less suddenly thrown on them. This is independent of the position of the brushes, and appears to be due to the average volts between the segments being too high. The machines are fitted with interpoles, and probably have a large number of turns per slot and too few commutator segments.

The type of brush-holder he mentions which swings from the spindle and grips the brush in a claw at the end is practically obsolete, its place having been taken by the type in which the brush slides in a box, tension being applied by means of an adjustable spring. This type of holder, when well made, is very satisfactory, and I have brought several old machines up to date, and increased their output by fitting them with this improved form of brush gear. In conclusion, I may say that I am not interested in any particular make, but gave a few impressions as the result of an experience covering over 2,000 motors.

Ernest F. Butler.

London, *April 20th*, 1914.

Vacuum Cleaners v. Chimney Sweeps.

May I venture to ask you to let me show through your columns how the above invention can supersede the services of a live sweep, and therefore further minimise the ordeal of spring cleaning?

The method can consist of either pushing a funnel-shaped bit up the chimney as far as the register and connected with the vacuum cleaner with a 6-ft. length of hose, causing the vacuum cleaner to blow the soot upwards out at the top of the chimney if such chimney be cowled; or, in the case of uncowled chimneys, the vacuum cleaner, in the case of detached houses and country ditto, could be fitted with a long tube screwed together in lengths, having at top a bent arm attached to a cap fitting over the chimney top. The soot could then be blown down the chimney into a sack at base of chimney within near the register. This sack's mouth would be kept open by a wire, and so remain wide open for the reception of the soot.

Henry James Saint Benno Cunliffe (M.A., Oxon.).

London.

Current-Limiting Reactances.

With reference to the remarks made by myself at the discussion in Birmingham on Messrs. Faye-Hansen and Peck's paper on the above subject, I wish to correct an impression that may be formed from the diagram published by you, and to state that the diagram was only intended to be approximate in the representation of certain conditions that had been investigated, and was given to show the serious results which might accrue in the case where all the details had not been properly considered. It does not represent the final arrangements which have been decided upon as regards the connections of the outside stations.

The amount of future synchronous motor load has also been over-estimated, and, generally speaking, the figures should only be taken as a first approximation to the conditions, and with a view rather to indicate the manner in which the problem should be tackled than the final conditions obtaining.

My point was to show that it was perfectly useless generalising in a case like this, and that each particular case must be treated on its merits with some approximation at least to the numerical values of the impedances obtaining in the different parts of the system.

I note that your printer has added to the diagram sent you, which was not labelled in the manner which you have done, and it is likely to give the impression that this is the final word in the Birmingham lay-out.

A. M. Taylor.

King's Heath, *April 18th*, 1914.

Speed Regulation of Induction Motors.

There is, I understand, a system of speed reduction of an induction motor by impressing suitable frequencies on the rotor (lower than the supply frequency).

What are the limitations of this method, and what its efficiencies and first cost? *i.e.*, is it commercial? I have not seen any of these details in print, and do not know where to put my hand on them.

R. E. M.

London, *April 18th*, 1914.

Protection or Tyranny?

The first paragraph of the letter appearing over the signature "Facts" in your current issue shows a capacity for misapprehending plain English which detracts much from the value of the rest of their letter.

In my previous statements I put the case as concretely as possible, giving to the "rule" a very definite form, and this form—and the *form* only—has been repudiated by the B.E.A.M.A. and by "Facts."

But surely it requires very little intelligence to understand that the main point at issue concerns the remedying of the serious discontents at present existing in the electrical trades—discontents which, rightly or wrongly, are attributed to the methods of the B.E.A.M.A. If the writers using the signature "Facts" are ignorant of this widespread dissatisfaction, without making any reflections on their business capacity, I would remind them that their evidence at best is negative, and refer them to the case of the Irishman who, accused of theft on the evidence of a witness who saw him stealing the articles concerned, retorted that he could bring a hundred witnesses who had not seen him.

Moreover, whilst the rule, as given by me, is repudiated with much useless rhetoric by "Facts" and by the officials of the B.E.A.M.A., the much more important letter of Mr. Fletcher, voicing as he does the ideas of an accredited Association, is passed over in a very suspicious silence. Can it be that Mr. Fletcher's statement is nearer the mark—as regards form?

I should be very glad to see a categorical statement with respect to Mr. Fletcher's letter from the officials of the B.E.A.M.A.

Little is asked of the Association. The existence of such dissatisfaction is detrimental alike to the interests of employers and employed, and frankness, rather than evasion, of the main point at issue is the first essential to a satisfactory solution of the problem.

The matter rests with the members of the Association. Will they seriously inquire into, and do their utmost to remove, the causes of this dissatisfaction? They will then earn the gratitude of all concerned with the electrical trades. Are they content to leave matters as they are? If so, we shall know precisely what value to assign to their rhetorical assertions of philanthropic motives.

With that portion of "Facts'" letter which concerns the points raised by Mr. Purse, I have nothing to do. Mr. Purse has shown such marked ability to take care of himself, that any intervention on my part would be distinctly superfluous.

Junius.

[In his letter, printed in our issue of March 20th, page 477, Mr. A. Bruce Anderson, chairman of the Council of the Association, said :—"If any such rule, or any semblance of such rule, or any latent desire for anything in the nature of such a rule, existed in the Manufacturers' Association, Lord Ampthill would not be its President, I should not be chairman of the Council, nor, I am sure, would any member of the Council be content to occupy that position."—Eds. Elec. Rev.]

I have been following the correspondence which has appeared under this heading in your columns during the last few weeks, and have been surprised at the attitude taken up by members and officials of the B.E.A.M.A.

One or two letters have appeared from their side, in which they profess that the ideals and objects of their Association are of the most laudable character, and yet it is difficult to understand how such ideals and objects are to be attained by the methods they are employing in this controversy.

Their failure to answer Mr. Fletcher's letter can hardly help to remove the belief—mistaken or otherwise—which exists in the minds of a great many men that some rule or understanding of the nature stated in Mr. Fletcher's letter, or the earlier one from "Junius," is practised.

I may say, for the benefit of both sides, that several cases of what appears to be the use of such a rule have been brought to my notice; their very nature, of course, makes them practically unproveable by the people who have an interest in proving them, so I can do no more than draw attention to what has been told me, and point out that the information comes from high officials of the firms concerned, and that the firms are members of the B.E.A.M.A., and rank amongst the largest in the country.

If the B.E.A.M.A. as a whole, or groups of its members, are not guilty of any such practices as are alleged, it is surely very easy for them to say so with unmistakeable clearness; if they are guilty, the policy of silence, which the chairman indicated was the desire of the Council, is their best defence and their surest proof.

Pollux.

April 18th, 1914.

Economy in Electric Lighting.

I enclose copy of a letter I have received from one of our consumers, which I thought might be of interest to you. This gentleman lives in a house, the rent of which is about £20 per annum, and is a fair sample of some of the consumers we have to deal with.

S. Pauls,
Borough Electrical Engineer.

Middleton, *April 18th*, 1914.

Dear Sir,—I enclose herewith my electricity account, and would like to ask if you think it fair to reduce the amount for the following reason. As soon as we came to the house we found that the hall lamp could not be switched off. We called in the electrician, who stated that the cause was dampness, and the lamp would probably go allright when the house was properly dry. After several weeks, however, there was no improvement, and we accordingly sent for the electrician again. It was then found necessary to completely renew one of the wires.

The lamp was really burning continually for two months, and I fancy this has been responsible for more than one half the units we are charged with, because, as I am out every evening, the house is mostly shut up at night, and we use very little electricity. Under the circumstances, perhaps you will be prepared to make an allowance.

On hearing from you I will immediately settle the account.

[The invoice charges for 29 units at 4d., 9s. 8d.; meter rent, 1s.; total, 10s. 8d., less 3d. discount.—Eds. Elec. Rev.]

Cable Corrosion.

I shall be obliged if you can give me an explanation of the corrosion of rubber-insulated cables drawn into earthenware ducts.

Quite recently I have had to deal with the repair of this class of cable on a direct-current network, and am of the opinion that the corrosion cannot take place unless there is an actual leakage of current at the point of corrosion.

The method of repair I have used has consisted of cutting out the corroded parts and re-insulating the whole length of cable with tapes coated with compound.

I am, however, doubtful as to this preventing further corrosion, and it might be useful to have related any experiences of your readers with this class of cable repair.

Mains Superintendent.

Review of Electrical Meters.

In the review of the above volume which appears in the current issue, your Reviewer asks whether the "Intermittently Recording Graphic Meter" which he saw at the 1905 Electrical Exhibition at Olympia is still on the market. He evidently refers to the inkless graphic instruments which we exhibited for the first time on that occasion, and we may say in reply that not only are they still "on the market," but that they are in constant demand and an enormous number have been supplied to meet almost every possible requirement.

When for electrical or other reasons the working forces cannot be made adequate, they offer almost the only solution of the problem of eliminating the effects of pen friction. Besides doing away with frictional errors, the inkless graphers have the advantage of requiring no attention whatever for a month or more at a time, and of ensuring the absolutely correct timekeeping of any number of instruments worked off a common control clock.

As mentioned by the Reviewer, these graphic instruments do not find a place in this volume, which is exclusively devoted to American apparatus.

While writing, may we be allowed to join issue with your Reviewer when he advocates expressing the error of an instrument as a percentage of the true value rather than of the reading. Thus, to take the example given by him, it is suggested that if a meter dial indicates 75 units, and is said to be 75 per cent. slow (a fairly large error we should imagine, even for America, where they never do things by halves), then the correct value would be 300 units. That is to say, 75 per cent. of the 300 units have not been metered.

Quite apart from the question whether such a definition is logical, which we venture to doubt, its adoption would be extremely inconvenient in practice. Seeing that it is to the instrument reading that the correction is to be applied, a large amount of calculation is avoided by expressing the error as a percentage of that reading. It may be added that that is the convention adopted by the National Physical Laboratory in all their certificates.

Everett, Edgcumbe & Co., Ltd.

London, *April 21st*, 1914.

Electricity in Coal Mining.

The statement *re* paraffin wax for joint boxes, on page 623, is one that is open to a lot of discussion. You will see I mention the subject in a paper (enclosed) read before a joint meeting of the A.M.E.E. and N.A.C.M., at Swansea, on February 14th, 1914.

I should be glad to hear the comparisons of other electrical engineers on the subject of the last paragraph of my paper, viz., energy consumption per ton of output of coal.

Since these figures were obtained the output has reached 6,500 tons in five days' working, with a consumption of 37,580 units for six days' running, or an increase of 1,380 tons of coal for an increase of 751 units for screening, haulage and winding.

I should also like to hear comparisons as to units generated per ton of coal burned, as I cannot find any data on this point from technical journals recording running costs, &c.

A reason for asking the last item is to find out if the use of anthracite coal is more economical than that of bituminous coal when working under similar conditions. My experience has been that on trying bituminous coal under our boilers the consumption was double that of anthracite and entailed much extra work for stokers.

J. Glynn Williams.

Cwmgwrach, *April 12th*, 1914.

THE OPERATION AND UPKEEP OF ELECTRIC MOTORS.

By E. F. BUTLER.

(*Abstract of an informal paper read before the* Junior Institution of Engineers, *on February 27th*, 1914.)

(*Concluded from page* 679.)

When the motor runs all day and is only stopped at meal times, a plain starter with a no-voltage release will usually be sufficient. The function of a starter is to start the motor; it is not intended to be used as a switch. If the circuit is to be made or broken it should be done by means of a suitable switch which makes and breaks quickly and preferably has auxiliary carbon contacts and a magnetic blow-out. All contacts should be renewable from the face. Except at starting no current should pass through the starter arm or spindle. The cover should be so constructed that it can be removed without interfering with the cables, and that it is not possible for the current to arc on to it.

The resistance coils should be vertical and firmly supported, and when wound on uralite or asbestos should have earthenware ends. It is an advantage to have the slate and coils mounted so that they can be lifted out together without disturbing the connections. As an alternative the case may be fitted with four removable covers.

The no-volt coil should be wound so as to release the arm before the motor is at half speed, and the iron keeper should be fitted with brass adjusting screws for this purpose. The ends of the coil should be connected to terminals on the opposite side to the starter arm. This is necessary, as cases have occurred in which the coil ends have got trapped between the arm and the magnet and caused trouble by breaking the shunt circuit. Although the no-volt coil is usually connected in series with the shunt field, this is not always the best way. A variation in speed of 3 to 1 by means of shunt regulation is common, and at the higher speeds the field current is often too small to keep the arm up. Also to comply with the Home Office requirements it is sometimes necessary to arrange to stop the motor from several points. In such cases the no-volt coil should be connected in series with a resistance and as many push buttons as necessary, and placed across the mains. Then by pressing a button the hold-up circuit is broken and the arm flies back. When it is necessary to regulate the speed of the motor by introducing resistance in the field circuit it is important to provide an electrical interlock so that it is impossible to start the motor up on a weak field. This, especially in printing equipments, is the cause of a great deal of trouble, burning of contacts, and flashing over in motors.

One way of doing this is to use a starter with two arms. The first arm starts up the motor in the usual way, the field resistance being short-circuited until the arm is at "full on" position. In this position the other arm can be moved until the desired speed is obtained. When the current is shut off both arms drop back and the field resistance is again short-circuited. In the case of motors having to start up under a heavy load, it is often advisable to have a starter of a somewhat larger capacity than the motor. If on the other hand the motor can be started up light, a starter of smaller size can be used. The greatest trouble with starters is due to getting the arm on the first contact and then moving it back to "off" position. A destructive arc is set up which burns the contacts, and often arcs to the cover. It is better to do away with the "off" position altogether, and replace the stud or segment on which the arm rests when in the "off" position by a metal one connected to the first section of the resistance. Then the motor gets current as soon as the switch is closed, and all making and breaking of current must take place on the main switch. This was done on a 70-h.p. motor working on 480 volts and taking twice full-load current at starting. After two years the contacts are as good as new, and show no signs of wear.

In a number of instances the no-volt coil gives trouble by working loose on the slate, and it is well to anticipate this by the use of either lock nuts or small spring washers. Another fitting that has the habit of working loose is the stop-block or buffer, on which the starter arm rests. Here again lock nuts or washers may prevent damage, and should the arm have a powerful spring, two buffers should be fitted so that the arm hits both of them. Automatic starters, generally speaking, require very little upkeep. The plungers should be coppered, or the solenoids lined with thin brass tube to prevent sticking. Carbon contacts should be fitted which definitely make contact before and break after the main contacts. Practically all forms of automatic starters are fitted with a resistance which is inserted in series with the lifting coil when the plunger is at the end of its stroke; most of the trouble in this type of apparatus arises from this resistance. It is well to replace such resistances with carbon-filament lamps mounted in back plate holders.

To facilitate the cleaning and inspection of motors a small wall socket should be fitted whenever possible, controlled by a fuse and tumbler switch and connected to the live side of the motor switch. This can be used for an inspection lamp, and if the size of the installation warrants it, for a small power blower to remove the dust and dirt from the motor and also from the control gear. The cost is not excessive. When open-type motors have to work under bad atmospheric conditions, such as acid fumes, special precautions are necessary. The motors should be taken apart and well coated with a good-quality acid-resisting enamel—armature, field coils, frame work, brush spindles and insulators, as much of the brush-holders as possible, and even the pigtails of the brushes. The commutator should be cleaned frequently and vaseline applied frequently while the motor is running. The starter, switch and fuses should be treated in a like manner. Motors so treated can be worked under very bad conditions without giving trouble. The running of motors fitted with fans in dusty places can often be improved by enclosing them in a box and running sheet-iron pipes to the outside of the building.

The greatest trouble with the ordinary d.c. motor arises at the commutator or brush gear, and usually shows itself in the form of sparking. There are in all about 36 different causes of sparking. The most common of these troubles is high mica or low segments, usually termed flats. In the case of belt-driven machines about 90 per cent. of the flats are due to bad joints or unsuitable belt fasteners. Excepting in the smallest sizes all belts should be properly spliced and sewn. Other causes of flats may be looked for in flywheels out of balance, gears irregularly worn, or motors unsuitably wound for their work, such as plain shunt motors on flat-bed printing presses, punches or planers. As a makeshift the mica can be cut slightly below the surface or recessed. Another cause of sparking is lack of tension, and is generally caused by neglecting to increase it as the brushes wear down. Sparking is also caused by brushes not fitting properly.

Some of the softer varieties of brushes swell when hot and stick in the holders. A too-loose fit on the other hand will cause chattering, and in a reversing motor will cause two wearing surfaces, finally becoming rounded or wedge shaped

at the end. This will also in time wear the holder out of shape. This fault is aggravated if the holder is too far away from the commutator. The proper distance from the bottom of the holder to the face of the commutator should be from ⅛ to 3-16 inch. One type of holder which swings from the spindle and grips the brush in a claw at the end, although not much used now, is common to a number of the older machines. If the brush wears down or falls out, as it very often does, the holder drops on to the commutator and damage is done to both. One way of preventing this is to drill a hole in the tip of the holder and fit a small peg or stop of insulating material to prevent the holder from making contact with the commutator. A better way is to scrap the holders and replace them by others of the box type; very often an old type of motor may be brought up to date and its performance improved by the substitution of a more modern type of brush gear.

It is often possible by slightly modifying the holders to use up more of the brush and so reduce the cost of running. In some machines the brush has to be replaced when less than half of it has worn away.

Many machines are sent out with the oil overflow set too high, and require adjusting so that the oil comes out of the overflow instead of getting into the motor. In motors having fans or in which the armature acts as a fan, oil creeping is somewhat common and can often be cured by fitting a cap over the end of the commutator bearing, and an iron plate or piece of leather on the driving end fitting closely to the shaft. Another cause of trouble is due to the oil grooves inside the bearing extending for part of the way along the bearing and then terminating. When this is the case, a recess should be turned in each end of the bearing, the oil grooves led into it, and a small hole drilled through the grooves at the bottom of the bearing to return the oil into the well. Very often the oil grooves are too small, and can with advantage be made wider and deeper.

THE SIGNALLING OF A RAPID-TRANSIT RAILWAY.

By H. G. BROWN, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 2nd*, 1914.)

The maximum headway which it is possible to obtain is primarily determined by the acceleration and deceleration rates and the maximum speed of the rolling stock, and the length (in time) of the station stops. The result is to a certain extent influenced by the geographical lay-out of the line, and also by the character of the limitations imposed by the signalling system, which must necessarily be installed for the purpose of creating safe conditions of operation.

With any of the present systems of signalling it is necessary to divide the line into signal sections, a signal being provided at the entrance of each section for the purpose of indicating the condition of the section, *i.e.*, whether occupied or unoccupied.

An automatic system can be arranged to allow of a far greater number of trains being operated than with any system of manual block signalling that affords an equivalent degree of safety. The apparatus of an automatic system operates practically instantaneously, while with the manually-operated system time is required for the performance of the manual operations. Under conditions that require a frequent train service it will be found that an automatic system is the cheapest per unit section.

On rapid-transit lines which are equipped with an installation of automatic signals, it is customary to provide train stops, which are located at the signals. These train stops assume an operative position when the signal is at danger, and should a train run past a danger signal, they co-act with the brake mechanism, causing an emergency application of the brakes, the train being stopped thereby.

Fig. 1 illustrates one arrangement of automatic sections. Signal 1 assumes the danger position when the front end of the train enters section A, and remains at danger until the rear end of the train has passed out of the section. Section A controls signal 1, section B

Fig. 1.

signal 2, section C signal 3, and so on. It will be noted that these sections overlap the signals in advance. This results in signal 1 not assuming the clear position until the rear of the train has passed signal 2 by a predetermined distance. A train passing a signal at danger at its maximum speed has its brakes applied by the train stop, and is thereby brought to a stand before it has travelled far enough to collide with a preceding train. The length of this overlap is influenced by alignment and grade, and is usually nearly double the length required for an emergency deceleration from maximum speed. This extra allowance is necessary because of the possibility of the deceleration rate being less than is considered normal, due to imperfect brake adjustment or greasy condition of the rails.

The time interval between trains being the important factor, the length of sections is considered in terms of time instead of distance; and it is obvious that the section in which a station is included may, on account of the station stop, be a longer section in time than a section between stations that is many times its length lineally, because between stations it can be assumed that the train is travelling at its maximum speed. The time occupied in a station section is long because, in addition to the time required for the stop, the average speed when the train is moving is lower than it is between stations, as the station section includes both a deceleration and an acceleration. When providing signalling arrangements for a short train interval, it will be found that the station sections are the ones most difficult of arrangement.

Fig. 2 is a train diagram showing the maximum headway through an ordinary station, and is based on the following data:—Maximum speed of trains, 25 miles per hour; acceleration, 1 mile per hour per second; service deceleration, 1·8 miles per hour per second; length of train, 300 ft.

Signal 1 is controlled by the section C E, and is usually called the home signal. The overlap B C is 400 ft. long. The overlap between D and E is 300 ft. long. The length of this overlap has

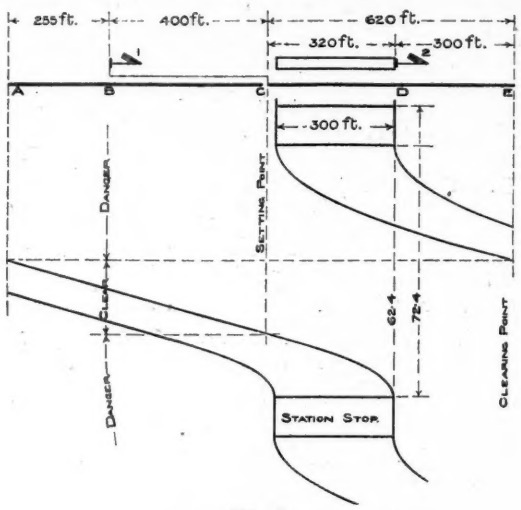


Fig. 2.

been reduced by 100 ft. because the section beyond E—being the starting section—is a relatively long one, and it can be assumed that a train stopping in this section would stop at the next signal. The distance A B is what may be termed the sighting distance.

With a deceleration rate of 1·8 miles per hour per second, if a train is travelling at the maximum speed of 25 miles per hour, it would be necessary to apply the brakes at a point 255 ft. in front of signal 1 in order to enable the train to be stopped at the signal.

The minimum interval between trains is determined by the time elapsing from the moment that the front end of the train passes A until the moment that the rear end passes E, and, as shown, this time equals 62·4 seconds plus the time elapsing while the train is standing in the station. Assuming a 10-second stop, the maximum headway possible would be 72·4 seconds. Should the station stop of the first train equal 21 seconds instead of 10, signal 1 would move to the clear position 11 seconds later than the time shown on the diagram. The resultant delay to the following train, however, would, from various causes, mentioned by the author, amount to 19·45 seconds, and under all conditions is greater than the original delay; the delay is quickly felt by all trains in the rear, and is accumulative. In addition, each train arriving after an interval greater than the normal finds more than the usual number of people on the platform, and thus the 10-second stop is likely to be exceeded. Hence the minimum train interval which is practicable with the signalling arrangements illustrated would probably not be less than double the theoretical minimum interval shown in fig. 2.

The station section is the critical one from the standpoint of time, and if a more frequent service is required the signalling arrangements at the station must be modified. The first step would be to provide one inner home signal, and it is possible that it may be considered advisable to install two or three inner home signals. This enables the trains to be run at shorter intervals without liability to disorganisation of the traffic.

If it is wished still further to increase the service, there is yet another arrangement of station signalling which is considered very satisfactory where it has been installed, and undoubtedly further reduces the time elapsing between the starting of the first train and the arrival of the next. With the speed-control system the second train is allowed to decelerate to a position very near the rear end of the train standing in the station, while in all the signal arrangements described a 400-ft. overlap has been provided. A train approaching an occupied station and decelerating properly finds that each signal clears just before it is reached, but if it fails to decelerate at a sufficiently rapid rate the brakes are applied by the next train stop because it has travelled through the approach section in too short a time.

The advisability of the use of the speed-control system as at present installed is open to argument, and the author is of the opinion that in the majority of instances it is better to maintain at all times a definite minimum distance between trains.

DISCUSSION.

MR. ROGER SMITH said that two types of signal were likely to be developed for railways, track signalling by train and cab signalling by locomotive; and for electric traction the signal and operating engineer had to use the same rails. There would come a time when the risk from stray currents would be too great for the signal engineer, and the A.C. track circuit could then be introduced; this could be superposed on either D.C. or A.C. of a different periodicity. It was important that the railway and signal engineers should get together at the beginning and fix the terms under which they would work. On the District line 44 trains per hour had actually been run, and it was proposed to run 50; he asked whether this number had been reached, as it appeared from the diagram was possible.

MR. BLACKHALL said his company had the signalling problem before it and was going to use an automatic system with three-position signals, control'ed by A.C. track circuits, and arranged to operate the brakes automatically and give audible signals to drivers. It was thought that it would have to be supplemented by treadles, because it was doubtful whether an A.C. track circuit would work properly with light engines and trucks on the line.

MR. FIRTH said he regretted that nothing was said about signalling at junctions and terminals, and asked how far automatic signalling would decrease their limitations, as those were just the places where automatic scored over manual signalling. Manual working was good on straight through routes, but rapid junction traffic could not be worked except with some automatic system. He referred to the influence of train design on station stops, and asked how the carrying capacity was affected by non-stop trains. What would be the effect on the signalling system shown if the length of train increased with growing traffic?

The AUTHOR, in reply, said it would be possible to operate at less than twice the theoretical stop if the stations were suitably placed and there were only one or two "critical" ones. It was true that the District ran 44 trains an hour, but it was a strenuous proposition. There were a number of short overlaps on that line, but they obtained dispensations from the powers that be, on the ground that otherwise it would have been impossible to operate. It was often necessary and practicable to reduce overlaps to 250 ft. Speed control was excellent so long as the drivers operated in a predetermined manner, but he found it was not being generally adopted.

BUSINESS NOTES.

Private Arrangements.—THE ELECTROMOBILE CO., LTD., Hertford Street, Mayfair, London, W.—The creditors interested herein were called together on April 16th, at the Connaught Rooms, Kingsway, W.C. The chair was occupied by Mr. Stewart Cole, chartered accountant, of Sardinia House, Kingsway, who had been appointed to act as the liquidator of the company in the voluntary liquidation. The chairman stated that he had also been appointed to act as Receiver for the prior lien debenture-holders. The position of affairs at present was that there were unsecured creditors for £1,600. The claims of the prior lien debenture-holders amounted to £2,000. That debenture bore interest at the rate of 6 per cent., and was issued on May 20 h, 1913. There were also first mortgage debentures bearing interest at the rate of 6 per cent. for £50,000. Of that amount £40,000 was issued in August, 1910, and the remaining £10,000 in August, 1911. In addition there were second mortgage debentures carrying interest of 5 per cent. for some £10,000 or £11,000. The lease of the premises at Hertford Street was mortgaged for £18,000. That meant a total mortgage and debenture charge of £80,000. When he took possession as Receiver there was cash at the bank of £230, and the other assets consisted of book debts estimated to realise £2,500, and stock of stores, tires, furniture, &c., valued at £1,500. It was difficult to say what the lease of the premises was worth, but for the present purposes he placed upon it a figure of £25,000, subject to the mortgage of £18,000. The company was registered on October 17th, 1902, with a capital of £50,000, divided into shares of the face value of £1 each. In 1908 the capital was increased to £75,000, and the following year it was increased to £125,000. During the first year the company made a loss of about £8,000. In 1905 there was a profit of £337, while in the succeeding 12 months the profit increased to £3,598. In 1907 the profit still further increased to £4,681, but since that time losses appeared to have been made. The losses had been as follows:—1909, £1,700; 1910, £4,800; 1911, £6,400; and 1912, £5,400. In addition there were certain heavy depreciations which had to be written off. The total deficiency at the present time was about £120,000. The chairman added that he was appointed Receiver on October 17th last, and entered into possession two days later. He had since been carrying on the business at a loss. With the sanction of the first debenture-holders, for whom another Receiver had been appointed, arrangements had been entered into for the sale of the assets to the Hertford Street Motor Hiring Co. Under the terms of the sale the prior lien debenture-holder would be paid in full, together with the interests and costs. The preferential claims of £1,400 or £1,500 would also be discharged. So far as he could see at present, there was no prospect of anything being paid to the first mortgage debenture-holders or the unsecured creditors.

In answer to questions, Mr. Cole stated that the whole of the assets were being sold to the Hertford Street Motor Hiring Co. R ughly, the buyers were giving about £4,000 for the assets of the company. They were also taking over the book debts.

A creditor asked what was the book value of the assets that were being transferred. Mr. Cole replied that originally the lease was valued at about £53,000, but the buyers were not taking over the lease. The first debenture-holders had entered into possession of the lease. By an arrangement between them and the mortgagees of the lease, the buyers were to take over the premises and pay the rent. The latter was payable to the first debenture-holders. The purchasers would take over the unexpired term of the lease. Any equity in the lease remained the property of the first debenture-holders. According to a balance-sheet of the company the stock of tires, furniture, &c., was valued at £1,500, the plant, tools, &c., at £5,000, and the stock of stores, tires, liveries and batteries at £7,000. Of the book debts, which were of the face value of £3,700, at least £1,200 were bad. The chairman added that the expenditure on the batteries had been terrible. That had been the real trouble in running the business. There were 40 carriages, which were held under a sort of hire-purchase agreement, but they had been removed.

No resolutions were passed, and the voluntary liquidation of the company will, therefore, be continued, with Mr. Cole as liquidator. The following are creditors:—

Hamburg and Vienna India-Rubber Co.	£31	Kalker & Co.	£17
Fletcher Lawrence	491	Hobdell, Way & Co.	14
Simpson & Sons	41	Continental Tyre Co.	17
Greenberg & Sons	20	Berk, F. W., & Co.	87
Lange, C.	44	Parsons, T., & Sons	60
Tee, E. E. & A.	26	Spottiswoode Advertising Agency	14
Hayward's Stores	15	Veritys Ltd.	18
Williams, J., & Sons	31	Fenton & Barnes	12
Whittingham, Thos. & Wilkin.	15	Manifoldia, Ltd.	84
Maple & Co., Ltd.	12	Premier Motor Clothing Co.	30
Marshall Tyre Jacket Co.	22	City and West End Laundry Co.	17
Hyde Archer & Co.	24	Patrician, The	26
Hill, T. H.	87	Wood, C. Gilbert	16

Ozonair Ventilation.—The following are among the ventilation installations which have been recently completed by MESSRS. OZONAIR, LTD., London:—

London.—Hong-Kong and Shanghai Banking Corporation; Excess Insurance Co., Ltd.; offices of the Metropolitan Asylums Board; Lloyd's Royal Exchange; and Euston and Edgware Road Tube Stations.

The Birmingham Exchange, and nine large picture theatres in Newcastle, Bradford, Leeds, Nottingham, Glasgow, Manchester and Edinburgh.

Stores of Messrs. Harrod's, Ltd., and those of Gath & Chaves, Ltd., both at Buenos Ayres.

House of Commons, Ottawa, and the Parliament House, Wellington, New Zealand.

Contracts now in hand include the ventilation of:—

The Town Hall and the Public Halls at Blackburn; Murray's Club, Ltd., London; and an installation for the Government of New South Wales at Sydney.

A deodorisation plant is being supplied for the press house of the Bradford Municipal Sewage Works, and a beeswax bleaching plant for the Russian Church Candle Works.

Installations of ozone generators for air purification have recently been fitted in London in the following:—

National Bank of India.
Standard Bank of South Africa.
Banca Commerciale Italiana.
La Société Générale.
Rubber Estates Agency.
Junior Constitutional Club, &c.

Catalogues and Lists.—MESSRS. KRUPKA & JACOBY, LTD., 26 to 36, Chapter Street, London, S.W.—Priced leaflets relating to the Kojok dry cell and Dr. Lessing's dry battery.

MESSRS. DICK, KERR & Co., LTD., Preston, Lancs.—Price card of Britannia metallic-filament lamps, made under Patent No. 11,455 of 1912, stating also the terms of the firm's indemnity.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—New leaflet, giving brief information and prices of their convertible table and bracket electric fans, and of the "Prangnell" combined lamp carrier and fan adapter.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, London, S.E.—Twenty-four-page catalogue (No. 537, new edition), giving full illustrated information and tabulated prices, weights, dimensions, &c., of their Siemens-Obach dry cells for general and ignition purposes, also ignition coils, Hellesen dry cells, Dura cells, Siemens transport cells, &c.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, London, W.C.—Catalogue of 32 pages, illustrating and giving prices of a large variety of electric advertising signs. These include a number of "Day and Night Signs" with raised luminous opal letters, as designed for particular businesses; fixed signs for theatres; programme indicators for music halls and cinemas; various box signs with accompanying bracket work; hotel and restaurant signs; shop window signs, artistic indoor signs, "Mirrorgraph" counter, collapsible and other signs. Any reader interested in the sign business will receive a copy of this catalogue on application.

MESSRS. LANGDON-DAVIES MOTOR CO., 110, Cannon Street, London, E.C.—Sixteen-page well-illustrated pamphlet, containing specification of their standard A.C. motors, accompanied by a 20-page price list of single phase (40 to 125 periods) and polyphase (25 to 50 periods) motors; prices of different types and sizes are

tabulated in detail. A third publication is devoted to "Megger" testing sets.

Messrs. Turners & Manville, Ltd., Hopetoun House, Lloyd's Avenue, London, E.C.—Revised edition of their illustrated price list of high-tension "Noark" fuses for from 2,500 to 22,000 volts, embodying their latest practice in this direction. Some 15 pages are occupied with a telegraphic code.

Messrs. J. H. Heathman & Co., Parson's Green, Fulham, S.W.—A set of illustrated price lists of extending ladders and ladder towers, telescopic trestles and ladders, fire escapes, and other specialities in a class for which the name Heathman has long been a household word.

The Dussek Bitumen Co., Canal Bank, Deptford, London, S.E.—Two pamphlets: one entitled "Joint Box Compound and its Tests," giving some particulars of "Trinidite" compound together with a report on tests of same made by Dr. Alex. Russell, and some comments by the firm respecting other box compounds, which it is thought will interest engineers. The second pamphlet consists of a list of electricity supply authorities using "Trinidite," and copies of testimonials.

Messrs. Lester B. Betts & Co., Ltd., 9, London Street, London, E.C.—No. 2 of *Betts's Bulletin* describing and illustrating a variety of electrical manufactures, and giving tabulated current market rates for a number of accessories and supplies.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—New catalogue of electric heating and cooking appliances. It comprises a collection of illustrated and descriptive price lists dealing with electric fire disks, reflector electric fires, pedestal and screen electric fires with disks, pedestal fires and boiling plates, stew pans, grills, breakfast cookers and electric ovens.

Sir W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester.—12-page illustrated list (No. 3,713) fully describing the "Strebor" cylinder escape valve.

Lantern Slides.—We have often pointed out the educational and advertising value of lantern slides showing electrical apparatus and machinery, and have noted with pleasure that a number of electrical firms have provided themselves with sets of slides, which are available for lectures, &c., on application. But not only apparatus, but also electrical phenomena can be dealt with in this way, as the Cambridge Scientific Instrument Co., Ltd., recently demonstrated by preparing a series of lantern slides from oscillograms obtained by Dr. J. A. Fleming, which show the phenomena involved in the discharge of condensers of various capacities through inductive circuits of various resistances. These slides are very suitable for lecture purposes in technical colleges. Other phenomena are included in the series, and obviously the idea can be applied to a variety of subjects for the instruction of students, as well as of the public generally.

Liquidations and Dissolutions.—The Grindell-Matthews Wireless Telephone Syndicate, Ltd.—Under a compulsory winding-up order made last January, on a creditor's petition, the report of Mr. H. E. Burgess, Official Receiver, has been issued to the creditors and shareholders. The statement of affairs showed liabilities £6,239 made up of unsecured debts, £3,083; preferential claims, £178; and loans on debenture bonds, £2,978. The assets are returned at £31,000, representing the value placed upon the patent rights, outfit, instruments and equipment. There is, consequently, a surplus of £24,761 in assets above liabilities, and one of £2,199 as regards contributories.

Mr. Burgess reports upon the formation and history of the syndicate, some particulars of which appeared in our issue of March 20th. He adds that the promoters (F. Rouse, Pool & Co.) had obtained an option to acquire the patent from Mr. H. Grindell-Matthews (the inventor), and they formed the syndicate in order to raise funds to enable them to exercise their option and to perfect the invention with the view to a sale to a larger company. The syndicate were to have the benefit of any further inventions in wireless telephony by Mr. Matthews, and the exclusive right of applying for, and obtaining, patents in the United Kingdom and foreign countries. According to the annual accounts the expenditure to September 30th, 1912, upon the development of the patent, demonstrations, stations, equipment and administration expenses was as follows:—Development of patent, staff, salaries, rent, erection of buildings, experimental and general expenses, £4,244; erection of workshop, equipment, outfit and instruments, £2,096; administration expenses, £2,565 = £8,905.

The total cash expenditure under the above heads amounted at the date of the winding-up order to about £11,000. The company have obtained patents in this country for the invention and for various improvements therein. Foreign patents have been taken out in the following countries:—France, Austria, Hungary, Canada and the United States of America. Options have been given by the company to acquire the patents and plant for cash and shares in a larger company to be formed to commercially exploit the invention, but such options have not been exercised. The present position of the company is partly attributed to the failure of other parties to exercise an option to take over the patent involving an obligation to discharge certain pressing liabilities, in respect of one of which the winding-up order was made. The value placed upon the patent rights, outfit, instruments and equipment by the officials in the statement is based upon the possibility of a scheme being carried out to continue the exploitation of the patents. Apart from this it is highly improbable that the value referred to can be realised. As the result of the statutory meetings held on March 10th, the Court has appointed Mr. H. Wilson, incorporated accountant, of 23, Devereux Count, Essex Street, London, W.C., to be liquidator of the company, with a Committee of inspection.

Wright Electrical Sales Co., Ltd.—This company is winding up voluntarily, with Mr. A. France, of West Bar Chambers, Boar Lane, Leeds, as liquidator. A meeting of creditors is called for April 27th, at Leeds.

Davis Electrical Co., Ltd., London.—Date of release of liquidator—Mr. H. de V. Brougham—April 16th.

E.M.F., Ltd.—This company is winding-up voluntarily, with Mr. G. Little, of 57, Moorgate Street, E.C., as liquidator.

Leicestershire and Warwickshire Electric Power Syndicate, Ltd.—This company is winding-up voluntarily, with Mr. T. W. Holland, of 34, Coleman Street, E.C., as liquidator. A meeting of creditors is called for April 30th.

Book Notices.—"Continuous and Alternating Current Machinery." By H. F. Morecroft. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

"Ornamental Lathework for Amateurs." By "C. H. C." London: Percival Marshall & Co. Price 3s. 6d. net.

"Post Office Electrical Engineers' Journal." Vol. VII, Part 1. April. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Science Abstracts." Sections A and B. Vol. XVII, Part 3. March 28th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the Institution of Railway Signal Engineers. 1913." Manchester: H. Rawson & Co.

"*Journal* of the South African Institution of Engineers." Vol. XII, Nos. 7-8. March. Johannesburg: The Institution. Price 2s.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 3. March. New York: The Society.

"*Bulletin* Scientifique de l'Association des Ecoles de Gand. March. Gand: Imprimerie Plantijn. Price 1 fr.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 3. March. Liége: The Association.

"*Giornale* ed Atti della Associazione Elettrotecnica Italiana." Vol. I, Nos. 7 and 8. April 5th and 15th. Milan: The Association. Price L. 1 each.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII, No. 232. April. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains a paper on "Current-Limiting Reactances in Large Power Stations," by K. M. Faye-Hansen and G. S. Peck.

"*Bulletin* of the Imperial Institute." Vol. XII, No. 1. January-March. London: John Murray. Price 2s. 6d. net.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part VI. April. Glasgow: The Institution.

"The Port of Hull Annual, 1914." Hull: H. E. C. Newham.

"The Physical Review." Vol. III, No. 3. March. Lancaster, Pa.: The American Physical Society.

"Factory Administration and Accounts." By E. T. Elbourne. London: Longmans, Green & Co. Price 25s. net.

"Catalogue of Lewis's Medical and Scientific Circulating Library." London: Lewis's Library. Price 2s. net.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 11. March. Toronto: The University.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 4. April. New York: The Institute Price $1.

"*Transactions* of the Illuminating Engineering Society." Vol. IX, No. 2. New York: The Society. Price 75 cents.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 4. April. Philadelphia: The Institute. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXVI, No. 4. April. New York: The Society. Price 35 cents.

"L.C.C. Report on Trade and Technical Education in France and Germany." London: P. S. King & Son. Price 1s.

"Publicacion Mensuel de la Asociacion de Ingenieros Industriales Agrupacion de Barcelona." February. Barcelona: The Association. Price 1 pta.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV, No. 33. March. Paris: Gauthier-Villars. Price 2 fr. 50.

"Practical Illumination." By Justus Eck. London: S. Rentell and Co. Price 1s. net.

Trade Announcements.—Messrs. J. Dodimead and Sons announce that their telephone exchange has been altered from Central to Museum, the number remaining unaltered—1137.

Messrs. T. W. Broadbent, Ltd., of Huddersfield, announce that Mr. J. D. Mackenzie, formerly their Scottish agent, has now ceased to represent them, and they have arranged with Messrs. James C. Fisher & Co., 62, Robertson Street, Glasgow, to act for them for the sale of A.C. and C.C. generators, motors, &c., in Scotland.

Messrs. W. & R. Jacobs have opened a depôt at 19, West Campbell Street, Glasgow, where Mr. H. M. Atkins will deal with all their clients in Scotland.

Messrs. Mawdsley's, Ltd., have appointed Mr. F. J. Lyons-Davis, of 23, Victoria Avenue, Cardiff, as their sole agent in South Wales for the sale of "Zone" dynamos and motors.

Messrs. Mickelwright, Ltd., of Alperton, have appointed Messrs. Phillips & Turner, 115, Edmund Street, Birmingham, as their agents for the Midland Counties.

Ebonite Telephone Parts.—The New York Hamburg India-Rubber Co., Ltd., of 89, Milton Street, E.C., has sent us some samples of finished ebonite parts for a hand set, which are highly finished, and appear to be admirably adapted for the purpose.

Barcelona Exhibitions, 1917.—It is the intention of Barcelona to make 1917 a very important year by means of two Exhibitions. The idea for an Exhibition of Electrical Industries has been followed by a project for an Exhibition of native products. Both Exhibitions will take place together, and we are given to understand that both have for their organisation and management a mutual Council board, on which sit the highest and most intelligent trade and political personages of Catalonia.

The International Exhibition of Electrical Industries and their applications of Barcelona, will embrace:—

(*a*) Machinery and apparatus which produce electrical power.

(*b*) Materials which accumulate, transform, transport and distribute electrical power.

(*c*) Apparatus, machinery and instruments operated by electrical power.

Group I.—Production, transformation and accumulation of electrical energy.

Group II.—Transmission and distribution of electrical energy.

Group III.—Apparatus and methods of investigation, demonstration and measurement of electrical power.

Group IV.—Electric lighting, domestic uses of electricity.

Group V.—Electric applications to manufacturing industries.

Group VI.—Electric traction, electro-mechanical maintenance.

Group VII.—Telegraphy, telephony and radio-telegraphy.

Group VIII.—Electric applications to hygiene and therapeutics.

Group IX.—Electro-chemistry, electro-metallurgy.

Group X.—Electricity in Army, Navy, and general sea services.

Group XI.—Electricity in agriculture.

Group XII.—Electricity in the exploitation of the sub-soil.

Group XIII.—General electric culture.

Bankruptcy Proceedings.—J. W. Garsden (J. W. Garsden & Co.), electrical engineer, Blackburn.—A first and final dividend of 6*s.* 2*d.* in the £ is payable on April 28th, at 27, Ainsworth Street, Blackburn.

D. Smith & Co., dealers in electric lamps, 2 and 3, Red Lion Court, Fleet Street, E.C.—First meeting, April 29th. Public examination, May 26th. Both at Carey Street, W.C.

W. H. Pease, of 17, Princess Royal Terrace, Scarborough, lately carrying on business at 19 and 20, Baxter Gate, Doncaster, electrical engineer.—A receiving order was made at the Sheffield County Court last week. The order was made on the debtor's own petition. First meeting, April 28th, at Official Receiver's offices. Public examination, May 14th, at County Court Hall, Sheffield.

Meter Contracts.—Messrs. Venner & Co. have received the contract for both ordinary and prepayment Chamberlain and Hookham meters for Colchester. Messrs. Chamberlain and Hookham, Ltd., have also obtained the contract for meters for Birmingham, West Hartlepool and Holyhead.

LIGHTING and POWER NOTES.

Ardee.—E.L. Tender.—The Town Commissioners have accepted the tender of Mr. J. W. McKeever for the lighting of the town with electricity.

Argentina.—The Municipality of Salto (Buenos Ayres) has granted a concession for 20 years for the electric lighting of that town. The contract provides for 100 arc lamps of 1,000 c.p. each at $27 per month. The concessionaire may also carry on private lighting.—*Review of the River Plate.*

Ashton.—L.G.B. Inquiry.—Mr. Hooper held an inquiry on Tuesday into the application of the T.C. for sanction to borrow £53,476 for the purposes of the electricity undertaking. It was stated that £34,924 of the amount was part of the application made in April, 1910.

Australia.—The Toowoomba (Queensland) Electric Lighting Co., which has acquired a new site for its power house, has arranged to install, at a cost of about £20,000, an entirely new plant.—*Tenders.*

Ayr.—Proposed Loan.—The T.C. has decided to apply to the Secretary for Scotland for consent to a loan of £25,000 for the extension of the electricity works, in connection with the inclusion of Prestwick in the supply area. The electrical engineer has been authorised to advertise for tenders for the necessary buildings and plant.

Banstead.—Prov. Order Granted.—The prov. order for E.L. applied for by Mr. Gilbert Allom has been granted, subject to the extension of the compulsory area of supply and the consent of the Epsom R.D.C. to the inclusion of part of its district.

Bispham.—The B. of T. has decided not to proceed further with the application of the U.D.C. for an E.L. extension order to supply electricity in Cleveleys.

Burton-on-Trent.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,000 for additional generating plant.

Carlisle.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £16,958 for additional plant and extensions at the electricity works. The Board has asked for further information before sanctioning a further loan for a second turbo-alternator and rotary converter.

Continental Notes.—Germany.—The question of the initiation of legislation in regard to the supply of electricity in Germany is engaging Government attention in that country. According to statements made by the Prussian Minister of Commerce in the Lower House of the Prussian Diet in March, negotiations have been proceeding between the Prussian Government and the Imperial Government for some time past in respect to legislative action concerning the Imperial regulation of the public supply of electricity. It appears that Prussia, in contradistinction to Bavaria, Baden and other Federal States, does not possess any roads which are under State control, and it is therefore impossible for Prussia to exercise a determining influence on the use of the roads for the installation of mains from public supply works. Such an influence, however, is considered necessary if the monopolistic endeavours of the large electricity companies are not finally to lead to the prejudice of the interests of the community. As electricity enterprises enjoy freedom of trading under the Imperial trade regulations, it would only be possible for Prussia to obtain an influence on the former by an alteration in these regulations, or by the passing of a special law.

Bulgaria.—The municipal authorities of Kustendil have decided to establish an E.L. undertaking in the town.

Hungary.—The municipal authorities of Budapest have decided to take over the E.L. undertaking from the concessionaires for a maximum sum of £100,000.

Austria.—The authorities of the Steinkohlengewerkschaft, of Dzieditz, have decided to establish a large generating station in connection with their collieries, with the view of supplying electricity to the many small towns and villages in the district.

Sweden.—The agreement between the South Swedish Power Co. and the North Zeeland Electric Works has been sanctioned by the Swedish and Danish Governments. The works will in a few years transmit 15,000 h.p. by submarine cable from Lagan, in Sweden, to North Zeeland. The cable under the Sound will be about 4¾ miles in length. The concession has been granted for 40 years.

Belgium.—La Société des Charbonnages du Sacré Madame has decided on the electrification of its entire plant. A power station is to be established in conjunction with the pits, but pending its completion current will be taken from the Compagnie d'Electricité du Bassin de Charleroi.

Netherlands.—A concession has been granted to the province of North Brabant for the construction of works for the supply of electricity.—*B. of T. Journal.*

Turkey.—The National Electric Construction Co. has completed in Constantinople the formation of a company, called La Société Anonyme des Tramways Eclairage et Force Electrique de Bagdad, for the construction and working of tramways and lighting undertakings in Bagdad. Important modifications of the concession have been arranged with the Turkish Government. The period of the concession has been extended from 50 to 70 years. The municipality does not participate in the profits for the first 20 years.

Deal and Walmer.—Prov. Order Granted.—The B. of T. has granted the prov. order for E.L. applied for by the Gas Co., but the powers in respect of the Borough of Sandwich and the whole area of the Eastry R.D.C. have been deleted. The Walmer U.D.C. has secured the option to purchase the E.L. undertaking, without the gasworks, at the end of 42 years, or any subsequent period of 10 years.

Dudley.—New Sub-Station.—The Worcestershire, Staffs. and Shropshire Electric Light Co. has acquired a site in Oakeywell Street for the erection of offices, and a 2,200-kw. substation, in connection with the Corporation undertaking recently taken over. The public lighting of the town has also been modernised, and further improvements are contemplated.

East Grinstead.—L.G.B. Inquiry.—An inquiry was held on April 16th into the application of the U.D.C. for a loan of £3,700 for a refuse destructor. The only objection raised was as to the position of the site.

Edinburgh.—New Generating Station.—The T.C. has approved of a site at Westbank, Portobello, for the erection of a new electricity generating station; the total cost of the site of 8¼ acres will be £15,800, and it will allow for the anticipated developments for the next 50 years. Sea water will be available for condensing, and a railway siding will be taken over with the land.

Eflon.—Hospital Lighting.—It has been decided to install electric light and a telephone in the Gordon Hospital.

Farnworth.—Year's Working.—The report of the Electricity Committee shows that for the year just ended, the units sold numbered 1,101,564, an increase over the previous year of 208,717, and the net profit was £256. The breakdown of two motor-generators in December last cost the Committee between £200 and £300. The agreement with the Lancashire E.P. Co. for a bulk supply was extended, and a contract for new plant at the electricity works was sealed during the year.

Girvan.—Proposed E.L.—The T.C. is considering a suggestion for the electric lighting of the town. Messrs. Purves, consulting engineers, Edinburgh, have offered to carry out a scheme, but a section of the Council favours a municipal scheme.

Guisborough.—Proposed E.L.—The U.D.C. has decided to engage the services of the electrical engineer for the Skelton and Brotton scheme to inspect the Guisborough district and report on the question of E.L. for the town.

Inverurie.—E.L. Scheme.—The T.C. has decided to obtain an engineer's report on the various E.L. schemes for the town. The G.N. of Scotland Railway Co. has been asked to quote for a bulk supply of about 10,000 units, and the establishment of a municipal generating station is also to be considered.

Kingstown (Co. Dublin).—Prov. Order.—The U.D.C. has decided to oppose the prov. order for E.L. for which Mr. W. M. Murphy is applying, and has appointed a deputation to visit London in support of a municipal scheme.

Leigh.—A sub-committee has been deputed to consider upon what terms the Corporation would be prepared to give the Anchor Cable Co., a stand-by supply, equal to the full capacity of the company's present demand. The company is considering the erection of an electricity generating station.

London.—Marylebone.—The working of the electricity undertaking for the nine months to December last shows a credit balance of £75,135, as against £72,391 for the corresponding nine months of 1912. Due to the abnormally fine and warm autumn, the increase in output during the quarter to December was very slight, except for the last three weeks. An interesting investigation was carried out by the department in regard to this circumstance. The income from several blocks of flats, supplied through the owners and not directly by the department, in which case there is lighting only, was found to be 12½ per cent. less than in the December quarter of 1912. In a case where the department deals directly with the tenants, the income was increased by 13 per cent. due to the use of current for heating and cooking. The publicity and sales department account for the December quarter shows a net credit balance of £126, as against a deficit for the corresponding period of 1912 of £230. It is anticipated that the economies due to the new plant will represent a saving of £3,800 during 1914-15, but capital charges will be £3,300 greater; a net surplus of £6,578 is anticipated after meeting interest charges, £72,055, and reducing capital liabilities by £48,177. In connection with the hiring of cookers, it is recommended that ½d. per unit be added to the present price of energy for such use, and that the hiring rate be reduced from the present quarterly charge of 15s. to 3s. 6d., the fixing charge being also done away with. The extra ½d. per unit will be credited to the hire of cookers' account. It is proposed to add a third rotary converter at Manchester Square sub-station, at a total cost of £3,202; to duplicate the canal condensing equipment, at a cost of £2,322, and application is to be made to the L.C.C. for sanction to the necessary loans.

Lossiemouth.—Street Lighting.—The T.C. has decided to light Gregory Place, Seatown, by electricity.

Lytham.—Bulk Supply.—The T.C. has come to an agreement, to hold for 10 years, with the St. Anne's T.C. for a bulk supply of electricity to Lytham. The Lytham Council retains its right to put down its own plant after 10 years, and is to receive a percentage of the revenue derived from the supply of current to the tramways company after May, 1917, when the agreement between the St Anne's Council and the company terminates. A L.G.B. inquiry was to be held to-day into the Lytham Council's application for sanction to loans for its E.L. undertaking.

Nelson.—Year's Working.—The Corporation electricity and tramways departments have had an exceptionally successful year. The estimated profit from the E.L. department was £249, whereas the actual profit amounts to nearly £2,000. A profit of £2,000 has also been made by the tramways, against the estimate of £652.

Newton-in-Makerfield.—Prov. Order.—The U.D.C. has been informed that the B. of T. proposes to grant the prov. order for E.L. applied for by the Council.

Paisley.—Proposed Extensions.—The Electricity Committee is considering the extension of the E.L. system to the south of the town before next winter.

Redditch.—Reconstruction Scheme.—The report of Messrs. Handcock & Dykes on the U.D.C. electricity undertaking, to which we have previously referred, makes most interesting reading, and one or two items are worth placing on record. We pass over the recital of boiler defects, and generators which have lost their original partners (gas engines) and received new ones of the steam variety, which appear to range from 35 kw. to a 300-kw. mixed-pressure turbine, which, however, can only be worked at high pressure, and come to load conditions. It appears that the annual output sold amounted to 1,323,878 units, with a load factor of 23·9 per cent.; this, however, required the use of 11·3 lb. of coal per unit, and the power factor of the supply was some 60 per cent. The plant is single-phase, 2,100 volts, 70 periods, and the reporters say they have been unable to find any instance of any of the sets being run together successfully in parallel, each set being run separately on a separate feeder or group of feeders. Even the feeders running out of the station are carrying double the maximum load usually considered desirable, and a complete overhaul of the L.T. system is also advised. The station buildings and sub-stations evidently fall short of modern requirements. Messrs. Handcock & Dykes's proposal for putting the undertaking on its feet is to install two 500-kw. turbine plants, and a three-phase supply for power, with which existing single-phase circuits and plant would be inter-connected, at a total cost of £18,000, and slightly to increase the charges for power.

Rhyl.—Loan Sanction.—The U.D.C. has received sanction to borrow £3,491 for the provision of a new Diesel engine set at the electricity works.

Rochdale.—Year's Working.—The past year's working of the Corporation electricity department has resulted in a net deficiency of £330, which will be taken from the reserve fund. In the previous year the undertaking contributed £2,000 to the relief of the rates. The total income for the year just ended was £30,471, an increase of £3,405, but the gross profit decreased by nearly £2,000.

Swanage.—Proposed Mains Extension.—The E.L. Co. proposes, if additional capital is subscribed locally, to extend its mains to New Swanage, at an outlay of £1,500.

Swinton.—Year's Working.—At the end of the last financial year the U.D.C. electricity undertaking, for the first time, showed a surplus. Application for a further loan is to be made shortly owing to extensions which have been carried out.

St. Albans.—The B. of G. has appointed a Committee to consider the question of introducing electric irons into the laundry, and the advisability of using dimming switches in the Infirmary.

St. Margaret's (Kent).—The P.C. has informed the B. of T. that the Dover T.C. has failed to supply the parish with E.L., and has asked whether it cannot be relieved from its obligation to take a supply from Dover. As the Council is dissatisfied with the position, the chairman has undertaken to interview the B. of T. officials in London.

Taunton.—Loan Sanction.—The T.C. has received the permission of the L.G.B. to a loan of £4,765 for electricity purposes.

Truro.—E.L. Scheme.—The E.L. Committee has recommended the T.C. to apply to the B. of T. for sanction to the acquisition of the Newnham site for the purpose of an electricity generating station.

Wolverhampton.—New Mains.—The Corporation Electricity Committee has decided to lay a H.T. main from School Street sub-station to Tettenhall Road sub-station, at an estimated cost of £1,575.

Yarmouth.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for a loan of £3 000 for cables, in connection with the electricity works.

TRAMWAY and RAILWAY NOTES.

Argentina.—Railway Electrification.—A Decree has been published approving the provisional plans for the electrification of the Buenos Ayres Great Southern Railway, on condition that the work is completed by December, 1915. It is proposed to distribute the present train movement at Once station between it and the subterranean transhipping station of Plaza Once de Septiembre, and to work electrically the service in the urban zone of Once to Versailles, which would be concentrated at the underground station named, connecting with the Anglo-Argentine tramway system.

The Compania Andina de Electricidad, which is under the control of the Compania Anglo-Argentina de Electricidad, has acquired the electric tramway concession which the Government of San Juan granted to Mr. Basualdo. Mr. Dirks, of the Siemens-Schuckert Co., is making the final studies in order to have the work started at once. The first line will join up the city of San Juan with Desamparados.

A decree has been issued approving the plans presented by the Central Argentine Railway Co., of the electric power station to be erected on the San Fernando Canal in connection with the electrification of the railway from Retiro to Tigre.—*Review of the River Plate.*

Birkenhead.—Year's Working and Estimates.—The traffic receipts of the T.C. tramways for the past year amounted to £67,782, an increase of £6,539 on the previous year. For the coming year the receipts are estimated at £67,000, and a balance of £3,577 is anticipated.

Canada.—The Ontario Legislature has voted £1,000,000 for the construction of a Government electric radial railway system and the supplementing of the present hydro-electric transmission lines.

Chesterfield.—Loan Sanction.—The T.C. has received the sanction of the B. of T. to a loan of £3,000 for three new tramcars (£2,550), and the extension of the tramcar shed (£450).

Continental Notes. — Austria. — New Electric 'Buses.—Battery 'buses have now been running between Volksoper and Stephansplatz (Vienna) for nearly two years, and with such satisfactory results that the Akkumulatoren Fabrike A.G. (Vienna) has offered to replace the municipality's existing horse-'buses by electric vehicles seating 29-33 passengers (as compared with 18 passengers in the existing electric vehicles). Weight and power requirements are to be reduced by using a light type of geared motor. The Austrian Daimler Co. is supplying the electric chassis and half a dozen experimental vehicles will be fitted with various types of bodies, having open and closed-in top seats, &c. Two Spängler bodies will be tried, these having low-step centre entrances and seating 33 passengers.—*E. u. M.*

According to the *Wiener Zeitung*, tests have recently been carried out on the Innsbruck-Scharnitz section of the Mittenwaldbahn to determine the practicability of increasing the number of carriages in the passenger trains. Hitherto no more than 17 axles have been allowed per train, but the present tests show that the power of the electric locomotives (draw-bar pull corresponding to 110 tons maximum load), and the Westinghouse brakes are sufficient for 25 axles. Working at the increased capacity is to be commenced this spring.

Italy.—The Milan Provincial Authorities have sanctioned the scheme for the conversion of the Milan-Saronno Railway to electric traction. The question of converting the steam railway between Rome and Tivoli to electric traction, is also under consideration.

Sweden.—Some trials are being made in Sweden with a new type of locomotive having a Diesel engine as prime mover, with electrical transmission to the wheels. The machine, in full running order, weighs about 33 tons, and is able to attain a speed on the level of 34 miles an hour, and on gradients of 1 in 10, up to 20 miles per hour. The new locomotive is stated to be specially intended for use on small local lines, where only a single carriage is needed to meet the traffic requirements.

Germany.—A short railless trolley line has recently been opened in Steglitz, a suburb of Berlin, and the local authorities have sanctioned several extensions. It is probable that during the next year a considerable network of such lines will be opened, as a company (Gleislose Lloydbahnen, Bremen) is seeking and obtaining concessions from a number of local authorities in the suburbs of Berlin. These lines are not in rural districts, but in thickly populated suburbs, and intersect an extensive existing tramway system. The principle reason for this difference from the English applications of railless traction is that whereas in Prussia town roads are usually asphalted, county roads have execrable surfaces; very cheap construction is also sanctioned for rural tramways. The railless system referred to above resembles the "Bremen" system as applied in Stockport, except that the two wires are in the same horizontal plane, the four-wheel over-running collector resembling a miniature crane crab, whilst an improved spring device takes in the slack cable effectively. The cars exchange collectors when passing. The vehicles are of the pay-as-you-enter type, with rubber tires, and motors built into the back wheels. They closely resemble the British railless cars in some respects, and represent a great improvement upon the earlier German cars.

In Bremen the railless trolley line has been replaced by ordinary tramways.

Glasgow.—All-Night Service.—The T.C. has approved of the principle of instituting an all-night tramcar service in the city.

Hounslow.—Electric Vehicle Report.—Following a recent report by Mr. Carey, the surveyor, the Council has decided to purchase an electric vehicle for house refuse collection. Tests with steam and petrol wagons showed that these were each capable of displacing the same number of horsed carts as the electric wagon. The cost per year of horse traction amounted to £405; the cost per annum of the electric battery vehicle for seven years is estimated at £333, showing a saving over horses of £72—or if hired teams are used, of £145. The comparative costs of steam and petrol on the same basis are given as £338 and £404 respectively.

The electric vehicle was an Edison truck, tare weight 3 tons 4 cwt., carrying 4,000-6,000 lb., priced at £840; the others were a 3-ton Garret steam wagon, tare weight 4½ tons, costing £617, and capable of hauling a trailer, and a 3 ton 4 cwt. Thornycroft petrol wagon, tare weight 3 tons 6 cwt., costing £815. Fuel costs are taken at: Electric, £23; steam, £23 8s.; petrol, £75 8s.; driver's wages at 30s. for the electric, and 35s. in each of the other cases; one day per month is allowed for overhauling for the electric and petrol wagons, and two days for the steam wagon, during which time hired carts would be employed. We notice that the items for tires and insurance are reckoned the same for all three vehicles, although there should surely be a saving in the case of the electric truck, in these items.

Japan.—A charter has been granted to the Nagoya Electric Tramway Co. for the construction of a light railway, about a mile long, between Kiyosu and Shinkawa, in the Prefecture of Aichi.

Leeds.—Year's Working.—For the year ended March 31st, the traffic revenue on the Corporation tramways was £423,516; the gross income, including a sum of £3,822 for advertising on the cars, was £427,455. The traffic revenue showed an increase of £15,914, which is a record. The working expenses were £226,382, leaving a gross profit of £201,072. Deductions from gross profit include sinking fund charges, £51,932; interest on capital, £42,176; permanent way renewals, £31,576. The net profit in relief of the rates is £70,004, which is equal to a rate of 8d. in the £.

Luton.—The B. of T. has extended the date for the completion of the tramways authorised by the Luton Corporation Tramways Order, 1905, from August 11th, 1914, to August 11th, 1916.

Manchester.—Estimates for 1914-15.—The estimates of the Tramways Committee for the coming year put the expenditure at £950,000, compared with £903,722 for the past year.

Padiham.—The T.C. has decided to object to the granting of an extension of time for the completion of the Blackburn, Whalley and Padiham Light Railways, for which Messrs. Warwick Webb & Co. are applying to the B. of T. The Council has been recommended to negotiate with the Burnley Corporation for the extension of the existing tramway to the western boundary of Padiham.

Southport.—New Cars.—Subject to the approval of the T.C., three more toast-rack tramcars are to be purchased.

Yarmouth.—Year's Working.—The total receipts of the T.C. tramways for the year ended March 31st, 1914, amounted to £25,712, an increase of £2,090 on the preceding year, and the passengers carried numbered 4,930,718, an increase of 415,847. Application is to be made to the B. of T. for permission to double part of the Regent Road tramway track.

TELEGRAPH and TELEPHONE NOTES.

American Marconi Shares.—Last week the hearing of the charges against Mr. C. E. Fenner, stockbroker, was in progress at the Mansion House, London. Evidence was given regarding the purchase of 200 American Marconi shares for Mr. G. R. B. Smith-Bosanquet, on the advice of Mr. Fenner, who quoted the favourable opinion of the Master of Elibank with regard to these shares.

Replying to a question in the House of Commons, the Prime Minister stated that the two Ministers who had held American Marconi shares had divested themselves of these.

Australia.—The Pacific Cable Board announces that arrangements have been made for the telegraphic transmission throughout of "week-end cable letters" to Australia without addition to the existing charge of 9d. per word, and to reduce the minimum number of words from 24 to 20, making the minimum charge 15s. instead of 18s. The arrangement will come into force in a few weeks' time.

Arrangements have been made under which, from May 1st, all week-end telegrams to and from Australasia will be delivered to the addressee on Tuesday, without extra charge. Registered addresses will be accepted for all week-end letter telegrams.

Imperial Wireless System.—The Post Office authorities of South Africa are considering the establishment of a wireless telegraph station at Springs, east of Johannesburg, to communicate with Nairobi, and thence with Malta, at a cost of £120,000 sterling.

Memorial to Wireless Operator.—On Wednesday last week, the second anniversary of the loss of the *Titanic*, a memorial was unveiled at Godalming to John George Phillips, the chief wireless operator, who was a native of that town. The memorial took the form of a cloister and tablet.

Telephone Contracts.—In reply to questions in Parliament, the Postmaster-General stated that the values of contracts at present placed for the construction of underground conduits for telephone cables and for telephone cables respectively, and the lengths in miles of the ducts and cables contracted for, were as follows:—

	London.	*Provinces.*
Contract value of underground conduits	£28,331	£404,800
Miles of single ducts	146	1,869
Contract value of cables	£186,700	£1,139,000
Miles of single wire	28,550	369,400

The values of contracts at present placed by the Post Office for telephone exchange equipments for London, and for other telephone areas throughout the United Kingdom, were as follows:—

	London.	*Provinces.*
Central battery	£239,465	£109,198
Automatic	£4,379	£149,131
Magneto	Nil	Nil

Telephone Employés.—The Postmaster-General last week received a deputation representing the Amalgamated Society of Telephone Employés, who laid before him grievances from which the various sections of the transferred telephone staff say they are still suffering. The interview was adjourned.

The Telephone Service.—A new exchange has been opened in Bloomsbury, called "Museum," with an ultimate capacity of 10,000 lines. This district has hitherto been served by the Central Exchange in the City, which will be much relieved by the transference of subscribers to the new exchange.

The P.M.G. states that space exists for additional subscribers' lines, aggregating 38,783, at 14 of the principal exchanges in London. Spare capacity is also available at practically all the suburban exchanges.

At the annual Conference of the National Chamber of Trade, at Blackpool, on Monday, resolutions were passed declaring that it was unfair to impose agreements upon telephone subscribers which did not admit of any appeal from the statements of the Post Office telephone department.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—The Municipality of Castelli, Buenos Ayres, is calling for tenders for the construction of electricity works. —*Review of the River Plate.*

Australia. — May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" April 3rd.

May 26th. Adelaide Tramways Trust. Overhead tramway equipment and construction. B. of T. Commercial Intelligence Department in London.

Victorian Railways.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

Sydney.—July 20th. Box compound, meters, maximum demand indicators, arc lamp carbons, and straight stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Belfast.—April 29th. Electric cable, for the Harbour Commissioners. See "Official Notices" April 17th.

Belgium.—May 20th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine). Supply and laying of a quantity of telephone cable in the Brussels district.

Bridgend.—May 6th. Glamorgan County Asylum. Electrically-driven lift for cold store. See "Official Notices" to-day.

Bulgaria.—The Bulgarian post and telegraph authorities in Sofia are about to invite tenders for a large quantity of telephone apparatus, cables and other accessories required in connection with the extension of the telephone service in the recently acquired extension of the country.

June 6th.—State coal mine at Pernik. Double electric elevator, complete with plant, at an upset price of 10,000 fr. (£400). Further particulars from the "Commission d'Adjudication, Bureau de Finances, Prefecture de Sofia," Sofia. Local representation. At the Commercial Intelligence Branch of the Board of Trade, London, a copy of the specification (in Bulgarian), together with drawings, may be seen.

Denbigh.—April 30th. North Wales Asylum. 700 ampere-hour battery, with booster, switchboard, &c. See "Official Notices" April 17th.

Devonport.—April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes.

Dundalk.—May 11th. U.D.C. Diesel generating plant, balancer and booster, motor generator, switchboards, battery, mains, crane, oil pipe line and storage tank. See "Official Notices" to-day.

Edinburgh.—May 6th. Corporation. Twelve months' supply of lead-covered, paper-insulated cables, for the Electricity Department. Specification from Mr. F. A. Newington, engineer, Electricity Supply Station, Dewar Place.

France.—Rochelle. April 30th. Tenders are invited for two groups of pumps worked by electricity at the Rochelle municipal pumping station at Périgny, 4 kilometres from Rochelle. This plant comprises two transformers, two motor pump groups with accessories, and high and low tension switchboards with accessories complete for working. Application must be made by letter to "le Maire de Rochelle" for permission to compete, before April 30th (5 p.m.) Those allowed to compete will be apprised by letter enclosing particulars of the competition.

Glasgow. — April 27th. Corporation. . .12 months' supply of cables, meters and arc lamp carbons. See "Official Notices" April 17th.

Hull. — April 29th. Corporation. Steel roofwork for tramway workshops. City Engineer.

Ilford.—April 28th. U.D.C. Battery booster, storage batteries, for Goodmayes Sub-station. See "Official Notices" April 17th.

Ilkley. — May 11th. U.D.C. Electricity generating station buildings. See "Official Notices" April 17th.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000 kw., 1,000 to 1,500 r.p.m., and condensing plant. See "Official Notices" April 3rd.

London.—Fulham.—April 29th. B.C. Coal for the electricity department for 12 months. Borough Electrical Engineer.

Lambeth.—April 28th. B. of G. Electric motors for Brook Street Infirmary; wiring and fittings at Children's Infirmary, &c., Crown Hill, Upper Norwood, S.E. Specifications, &c. (£2 in each case) from the offices, Brook Street, Kennington Road, S.E. See "Official Notices" April 17th.

Metropolitan Asylums Board. — May 6th. (1) Electric light installation at Grove Fever Hospital; (2) rewiring fire alarm and telephones, &c., at Southern (Lower) Fever Hospital; (3) milk pasteurising and motor-driven plant for Eastern Fever Hospital. See three "Official Notices" to-day.

Malvern.—April 27th. U.D.C. Vertical compound steam engine, direct coupled single-phase 150-kw. alternator, exciter, &c. See "Official Notices" April 17th.

Manchester. — May 13th. Corporation. 5,000-kw. turbo-alternator complete. See "Official Notices" to-day.

Portugal.—Lisbon.—May 22nd. Construction and working of a 12-km. line of electric tramway between Lamego and the right bank of the Duro. Particulars of the Direccao-General das Obras Publicas e Minhas, Lisbon.

Sheffield.—May 2nd. B. of G. Installation of telephone and fire-alarm system at the Workhouse, for the Guardians. Ecclesall Bierlow Union. Specification from the Clerk, Union Offices, The Edge, Sheffield.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the electricity department. See "Official Notices" April 3rd.

Warrington.—May 12th. Extra-high and medium-tension paper cables, for electricity department. See "Official Notices" to-day.

York.—May 12th. Feeder cables for electricity department. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Edison & Swan United Electric Light Co, Ltd., have secured part of the contract for the supply, for 12 months, of Royal Ediswan lamps to the British Admiralty. The new Cunard liner ss. *Acquitania* is being installed throughout with these lamps.

Australia.—According to *Tenders*, the tender of the British Insulated and Helsby Cables, Ltd., at approximately £300,000, for overhead electrical equipment for the electrification of the Melbourne suburban railways, has been accepted in London by Messrs. Merz & McLellan.

P.M.G.'s Department:—

Victoria—600 lead earth plates, 7s. 6½d. each; 500 ditto, 7s. 9d. each.—J. Bartram & Son, Pty., Ltd.

South Australia.—500 magnetic wall telephones, £2 11s. 6d. each; 550 c.b. table pavern telephones, £1 10s. each—J. Bartram & Son, Pty., Ltd.

New South Wales.—Ammeters and voltmeters, £57.—I.-R., C.-P. and Telegraph Works Co., Ltd.

360 magneto bells, £132; 2,500 three-part plugs, £153.—James Paton & Co.

1,150 condensers, £110.—B.I. and Helsby Cables, Ltd.

1,500 conductor cords, £116.—Lawrence & Hanson Electrical Co., Ltd.

Howlers, strip indicators, keys, number plates, receivers and translators. —Western Electric Co. (Aus.), Ltd.

Victorian Railways Department.—Automatic telephone sets, £169.—Automatic Telephones (Aus.), Ltd.

N.S.W. Public Works Department.—Walsh Island workshops. —Paper-insulated, lead-covered, steel-tape armoured cable and accessories, £1,219.—W. T. Henley's Telegraph Works Co., Ltd.— *Tenders.*

Bedford.—The T.C. has accepted the tender of Messrs. Siemens Bros. for cables. The lowest tender was for Italian-made cables which were not in accordance with the specifications.

Belfast.—The Harbour Commissioners have accepted the tender of British Insulated and Helsby Cables for 36 cwt. of copper wire and 36 cwt. of copper strip.

The tender of Messrs. W. Coates & Son, Ltd., has been accepted for an electric installation in St. George's Church.

Bristol and Newport.—The tender of Messrs. Siemens Bros. Dynamo Works Co., Ltd., for carbon filament lamps has been accepted by the Bristol City Tramways; their tender to the Newport Corporation for a quantity of similar lamps has also been accepted.

Bootle.—The Corporation has placed a contract with the British Thomson-Houston Co., Ltd., for one year's supply of their M.H. type mercury meters.

Canada.—The Regina City Council has awarded the contract for the erection of a new electric power house to Messrs. Wilson & Wilson, at $90,800, and has placed the following contracts for copper wire:—

75,000 lb., $14,197.—Northern Electric Co.
70,000 lb., $13,034.—Whiteford Bros.
70,000 lb., $13,160.—Deering Electric Co.
69,000 lb., $12,989.—H. W. Laird Co.—*Canadian Engineer.*

Consett.—The Consett Iron Co. has accepted the tender of Sir W. H. Bailey & Co., Ltd., for a "Kosters" patent electrically-driven air compressor.

Colchester.—The Corporation has accepted the following tenders for stores for the electricity department:—

Ironmongery, tools, oilmen's stores, castor oil, prepayment installations—Joslin, Ltd.
Castings.—Stanford & Co.
Fuse-boxes.—Lucey & Co.
Ordinary meters.—Venner & Co. and Reason Manufacturing Co.
Prepayment meters.—Venner & Co.
Carbon and metal-filament lamps.—Drake & Gorham, Ltd.

Coventry.—The B. of G. has received the following tenders for installing electric light in the old infirmary block, balconies and verandahs:—

	No. 1 Scheme.	No. 2 Scheme.
H. W. Burbury & Co.	£144	£350
T. Reynolds & Co.	£120	£316
Lee, Beesley & Co.	£148 (accepted)	£252
F. C. Brown & Co.	£96	£223

Messrs. Lee, Beesley & Co.'s tender (No. 2 scheme, £252) was accepted.

France.—La Société des Ateliers de Constructions du Nord de la France, has secured a contract from the Société des Tramways de Paris for the supply of 25 electric motor tramcars, and from the Metropolitan Railway, of Paris, for 36 passenger carriages equipped with motors.

Glasgow.—The Tramways Committee has accepted the following tenders:—

Special trackwork.—Lorain Steel Co.; Titan Trackwork Co., Ltd.
Torch lamps.—J. T. Donald & Co.
Steel work for new turbine foundation, Pinkston.—Redpath, Brown and Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

Admiralty.—Contract Department.

Distributing, section, junction, &c., boxes.—Callender's Cable Co., Ltd.; Cantie Switch Co., Ltd.; Chadburn's (Ship) Telegraph Co., Ltd.; Crompton & Co., Ltd.; Edison & Swan Co., Ltd.; Hawker's, Ltd.; W. McGeoch & Co., Ltd; Player & Mitchell; Spagnoletti, Ltd.; Telford, Grier & Mackay, Ltd.

Works Service.

New wireless telegraph station at Lerwick.—G. Hall.

War Office.

Overhead conductors and supports for electricity supply, Netheravon.—G. E. Taylor.

Crown Agents for the Colonies.

Alternators.—Electric Construction Co.
Switchboard.—British Thomson-Houston Co.
Telegraph material.—F. Smith & Co.
Telephone material.—Siemens Bros. & Co., Ltd.

India Office: Store Department.

Cables.—London Electric Wire Co. & Smiths.
Electric plant.—Gilbert Gilkes & Co.
Insulators.—Bullers, Ltd.
Panel plates.—Smith & McClean.
Sounders.—Automatic Telephone Manufacturing Co.
Copper Wire.—F. Smith & Co.; Shropshire Iron Co.; T. Bolton & Sons; Callender's Cable, &c., Co.
Iron wire.—Dorman, Long & Co.; White Cross Co.; Shropshire Iron Co.

Post Office.

Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone and Electric Works; Western Electric Co., Ltd.
Battery boxes.—British L.M. Ericsson Manufacturing Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Insulators.—Bullers, Ltd.
Telegraph paper.—Waterlow & Sons, Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co., and Smiths, Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.; J. Wilks, Sons & Mapplebeck, Ltd.
Galvanised iron wire.—Ryland Bros., Ltd.
Electric lifts, Birmingham Telegraph Factory.—Medway's Safety Lift Co.
Electric lift, Glasgow Parcel Office.—Wm. Wadsworth & Sons Ltd.
Electric lifts, Leeds Telephone Exchange.—Medway's Safety Lift Co.
Laying lines of ducts, Dover, Folkestone.—W. Dobson.
Do., Holborn Circus, E.C., and Kennington Park Road, S.E.—J. Mowlem & Co. Ltd.
Do., Leeds, Bradford (Leeds section).—Wm. Irwin & Co., Ltd.
Do., Pembridge Square, W.—O. C. Summers.
Laying lines of pipes and ducts, Huddersfield-Dewsbury (Huddersfield section).—J. A. Ewart, Ltd.
Telephone exchange extension equipment (Bristol).—Western Electric Co., Ltd.
Do., London (Official).—Automatic Telephone Manufacturing Co., Ltd.
Do., London (Victoria).—Peel-Conner Telephone Works, Ltd.
Do., North Shields.—Automatic Telephone Manufacturing Co., Ltd.

Hastings.—The Council has accepted the tender of Messrs. Tangyes, Ltd., for twin gas engines of 81 B.H.P., together with suction gas plant and three-throw pumps to deliver 40,000 gallons of water per hour for the Corporation waterworks at Filsham, at £4,650.

The Hastings Corporation has accepted the tender of Messrs. Myers, Rose & Co., for the supply of 450 tons of best Welsh anthracite coal, at 28s. 4d. per ton delivered. The coal is required for the suction gas plant at the various water pumping stations.

London.—St. Marylebone.—The Electricity Committee recommends the acceptance of the following tenders for underground cables:—Electrical Engineering and Equipment Co. (Ateliers de Constructions Electriques, Charleroi)) 22 items; H. W. Butler & Co. (Ateliers de Constructions Electriques du Nord et de l'Est, Jumont), four items; house wires and cables, Geipel and Co. (I. Suddeutsche Kabelwerke A.G. Mannheim).

Londonderry.—The Corporation has accepted the following tenders for the supply of stores for the Electricity Department:—

Engine room stores.—Maxwell, Greer & Co., Ltd.
Electric meters.—Ferranti, Ltd.
Cables.—Western Electric Co., Ltd.
Bitumen.—Dussek Bitumen Co.
House fuse-boxes.—Reason Manufacturing Co.

Newport (Mon.)—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for 206 tons of tramway rails and fishplates, at £1,587.

Paisley.—Messrs. Richardsons, Westgarth's tender for the supply of a turbine and alternator, with Siemens condenser, &c., has been accepted, at £9,400.

Salford.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract from the T.C. Tramways Department for Wotan, tantalum, and carbon-filament lamps for 12 months.

Swindon.—The Corporation has accepted the tender of the Electrical Apparatus Co., Ltd., for D.C. meters of 2½ amperes capacity for the ensuing year.

West Hartlepool.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of Bastian meters up to 10 amperes.

Walthamstow.—The U.D.C. is recommended to accept the tender of Messrs. John Baker & Co., Ltd., for the supply of steel tires for tramcars, at £15 10s. per ton, for the period ending March 31st next; also that of Messrs. A. Usher & Co., for an annual supply to the Electricity Works, of Griff, Kingsbury, Shipley and Ansley Hall peas, and Baddesley beans coal, at 12s. 6d. per ton—between 10,000 and 11,000 tons.

Wolverhampton.—The Corporation Tramways Committee has decided to purchase three motor equipments from Messrs. Dick, Kerr & Co., Ltd., at £765. Messrs. T. & S. Ham have received the contract at £2,595 for extensions to the buildings at the Commercial Road Station. The quotations of the Holly Bank Coal Co., Ltd., and Messrs. Brentnall & Cleland for the supply of fuel for the electricity works, have been accepted.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, April 24th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, April 25th.—Headquarters will be open for Regimental purposes only from 10 a.m. to 12 noon.

Monday, May 4th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, May 5th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, May 6th.—Musketry at Purfleet from 1 p.m. to dusk.

Thursday, May 7th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, May 8th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, May 9th.—Headquarters will be open for regimental purposes only from 10 a.m. to 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 24th. At 8 p.m. At 39, Victoria Street. Paper on "A Visit to the Iron Districts of French Alsace," by Mr. G. Evetts. At 7.45 p.m. At Municipal School of Technology, Manchester. Meeting of North-Western Section. Paper on "Some Notes on the Application of Chain Gearing," by Mr. H. T. Hildage.

Monday, April 27th. At Birmingham. Meeting of the Midland Section.

Friday, May 1st. At 8 p.m. At 39, Victoria Street. Paper on "The Control and Organisation of the Engineering Profession," by Mr. S. T. Robson.

Institution of Civil Engineers.—Friday, April 24th. At 8 p.m. Students' meeting. Frame Thomson lecture on "Engineering Contracts," by Mr. A. A. Hudson.

Institution of Electrical Engineers (Newcastle Local Section).—Friday, April 24th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Industrial Applications of Electrically-Produced Ozone," by Mr. E. L. Joseph.

(Newcastle Students' Section).—Monday, April 27th. At 7.30 p.m. At Armstrong College. Paper on "Electric Ship Lighting," by Mr. B. S. Orme.

(Dublin Local Section).—Saturday, April 25th. At 8 p.m. At Lecture Theatre, Leinster House, Kildare Street. Conversazione.

(Manchester Local Section).—Tuesday, April 28th. At 7.30 p.m. At the University (Physical Laboratory). Lecture by Prof. J. A. Fleming, F.R.S.

(Students' Section).—Wednesday April 29th. At 7.45 p.m. At Victoria Embankment. Annual General Meeting. Discussion, "The Students' Section."

Institution of Mechanical Engineers.—Friday, April 24th. At 8 p.m. At Storey's Gate, S.W. Paper on "Application of Electrical Driving to Existing Rolling Mills," by Mr. L. Rothera.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 24th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

(Graduates' Section).—Saturday, April 25th. At 7.15 p.m. Paper on the "Gyroscopic Compass," by Mr. H. C. Stroud.

Physical Society.—Friday, April 24th. At 5 p.m. At Imperial College of Science, South Kensington. Ordinary meeting.

Batti-Wallahs' Society.—Friday, April 24th. Smoking concert.

Royal Society of Arts (Colonial Section).—Tuesday, April 28th. At 4.30 p.m. At John Street, Adelphi. Paper on "The Administration of Imperial Telegraphs," by Mr. C. Bright.

Wednesday, April 29th. Paper on "The Need for a Better Organisation of Economic and Industrial Resources," by Mr. C. R. Enock.

Royal Institution of Great Britain.—Tuesday, April 28th. At 3 p.m. At Albemarle Street, W. Paper on "Problems of Physical Chemistry: (2) Structure of Matter at Low Temperatures," by Dr. W. Wahl.

Electrical Contractors' Association.—Wednesday, April 29th. At 6.30 p.m. Reception, 7 p.m. Dinner at Grand Hotel, Leicester.

Salford Technical and Engineering Association.—Saturday, May 2nd. Visit, Park Works, Newton Heath.

NOTES.

Concert.—To-morrow night (Saturday), at 7.30 p.m., at the Great Hall, Cannon Street Hotel, E.C, the third annual smoking concert of the electrical engineers' department of the Great Eastern Railway is to be held. Mr. H. W. Firth, M.Inst.C.E., electrical engineer to the G.E.R., will take the chair. The artistes are as follows:—Miss Violet Oppenshaw, Miss Marjorie Bowen; Messrs. Peter Dawson and George Foxon; Mr. Ernest Hastings, entertainer at the piano; Mr. Olley Oakley, banjo soloist; Mr. George Blackmore, humorist; Dr. Lynn, prestidigitator; Mr. Bernard Flanders, accompanist and musical director.

Fires in London.—Last year there were 158 fires in the City, of which 16 were caused by defective electrical fittings. On Wednesday last week fire broke out in the Mansion House on the floor of a service room beneath a plate-warming apparatus *fed by gas jets*. The flooring was found to be well alight. The fire brigade were called and the fire was quickly subdued, though not until a considerable space and depth of flooring had been burned through. There is no record of any previous fire in the Mansion House during its existence of 161 years.

A Boston Campaign.—In order to stimulate the volume of sales and the general growth of the business, the Edison Electric Illuminating Co. of Boston is conducting a campaign among its employés looking to the securing of a connected load of over 4,000,000 50-watt equivalents before July 1st. The campaign began about February 1st, when the company's load was 3,764,000 equivalents, and interest has been aroused and stimulated by means of a letter from Superintendent W. H. Atkins to every employé, in which he urged every person in the company's service to join in this campaign; the company publication, *Edison Life*, carried forward the project through advertisements and editorially calling upon the employés to work towards the desired end. Placards posted throughout the company's offices call attention to the same thing, and a "thermometer" indicates the progress of the campaign. Every letter passing between the various departments bears the following slogan, stamped upon it:—

Four million or more
July first or before.

On March 27th the company's total connected load was 3,814,852 equivalents. The average of 1,900 equivalents per day is needed to reach the goal.—*Electrical Review and Western Electrician.*

Output of Coal.—The Home Office issued on Saturday an advance proof (subject to correction) of the tables relating to the output of coal and other minerals in the United Kingdom, and the number of persons employed at mines during 1913. The document shows that the output of coal from mines under the Coal Mines Act, which was 260,398,578 tons in 1912, rose last year to 287,411,869 tons, an increase of 27,013,291 tons. The total is the highest on record. There was a total of 1,127,890 persons employed at mines under the Coal Mines Act, an increase of 38,800 on the previous year. The increase in the output of coal is at the rate of 10·37 per cent., the increase in the number of persons employed at the rate of 3·56 per cent.

Electric Cooking on Submarines.—Writing in a recent issue of the *Pall Mall Gazette*, its Naval correspondent, in referring to a rumoured new type of British submarine, states that the electric cooking range is installed in the E class, "and a very handy little apparatus it is. You can cook a five-course dinner in it, and it occupies a space represented by about 2 ft. × 4 ft. × 3 ft."

Fraud.—At a special sitting of the Newcastle-on-Tyne Police Court on Monday, William Walton, *alias* Currie (34), who was stated to have swindled electrical firms in all quarters of the kingdom, was sentenced to six months' imprisonment on three specific charges of fraud. The solicitor for the prosecution, in opening the case, said prisoner was a man of education and ability. It was not a case where a poor creature had been tempted to crime, but one in which the accused had deliberately chosen to follow a course of fraud. One of the three cases, which had been selected out of many upon which to base the prosecution, related to two dynamos, two switchboards, one bulb case and six electric bulbs, valued at £31 8s. 11d., alleged to have been obtained from Messrs. S. Smith & Sons, Ltd., of 185, Great Portland Street, London, W. During the short while he had operated from Newcastle, 24 firms had been defrauded, and the value of the goods amounted to £182 11s. 2d. Trading as W. Walton & Co., from an office for which he paid 7s. per week rent, but which contained no furniture whatever, he sent out his orders broadcast. When the goods were delivered, they got no further than the passage, where they were promptly redirected to an address at Bolton. And here the prosecution was placed in some difficulty, because one of the witnesses on whom they had depended, named Thomas Cooper, had that morning admitted the writing of certain letters to prisoner, from which it was assumed that he had participated in the frauds. Moreover, it was only the inability of the criminal law to deal with a man and his wife on a conspiracy charge that prevented the prisoner's wife from appearing in the dock by his side. The Newcastle police proposed to communicate the whole of the facts to the Bolton police, and leave them to take such action against Cooper as was necessary. Up to 1911 prisoner appeared to have held a most lucrative position as a commercial traveller. During the latter part of 1913 he carried on a business under the name of Briggs & Co., at Preston. From there the goods received were sent on to Blackburn, and there converted into cash. Pleading for clemency, accused's solicitor said his client was educated to the finger-tips, and connected with a well-known Edinburgh family. For 13 years he carried on a remunerative business, but, unfortunately, he overdrew at the bank to the extent of £250. Ill-luck followed him, and at last he gave way to the temptation of going the wrong way. He promised faithfully, however, to do his level best to retrieve. The Bench, in passing sentence, said they had a certain amount of sympathy with him, but, at the same time, they realised that traders must be protected against frauds of the kind before them. The term of six months' imprisonment would be without hard labour.

The Effect of Dirt on Reflectors.—In a review of a book on "Factory Lighting," by Mr. C. E. Clewell, published in our issue of the 10th inst, the reviewer referred to some figures which the author gave showing the loss of light due to dirt deposited on lamps and reflectors, and incidentally commented adversely on Holophane shades, to which he applied some of the author's results, as compared with opal and metal shades. It is but fair, however, to state that throughout the chapter in which these data occurred, the author made no explicit reference to any particular make of shade, and did not institute any comparisons between one class of shade and another. In fact, his object was to show the importance of cleaning both lamps and reflectors at regular and frequent intervals, and he was not testing the efficiency of the shade *per se*. The deterioration in any given case depends upon the conditions obtaining in that case, and the type of reflector should be chosen to suit those conditions; when this is done, the prismatic reflector is capable of holding its own with opal, metal, or any other type of reflector, and data are extant of prolonged tests which prove this.

Accident.—With reference to the reports in the daily Press concerning an accident which occurred last week to three employés of the Shoreditch electricity department, we find upon inquiry that the facts of the case were as follows:—

At 11.45 a.m. on April 15th an intermittent earth occurred on the 1,100-volt D.C. trunk main between Whiston Street and Coronet Street power stations, which eventually developed into a short-circuit and broke down the trunk main. Three men who were in the neighbourhood of the manhole where the trouble occurred were injured when the explosion took place. One of them had to be sent to the hospital, and was detained for one night, but the other two men were not injured seriously and are at work again.

Institution and Lecture Notes. — Association of Mining Electrical Engineers.—At a meeting of the South Wales Branch on February 14th, Mr. J. Glynn Williams read a paper on "Electrical Equipment for Low Energy Consumption," in the course of which he said that some electrical engineers advocated the use of paraffin wax for filling joint boxes, but he was satisfied to take the experience of paraffin candle moulding-machine makers, who found that paraffin wax ate into the copper and lead. For this reason they were compelled to use pure tin for moulds, although the cost of tin was several times higher than copper. They also relied on the shrinkage of the wax when cold to allow the candles to be expelled from the mould, and this pointed to the fact that there would be shrinkage in a joint box if wax were used. This would allow moisture from a humid atmosphere such as was met with underground to creep into the box. It was always advisable to put a layer of pure rubber strip over a joint before using Empire tape which had been paraffin-waxed. Oil-immersed controllers and reversing switchgear should have large oil tanks. A 350-H.P. motor stator reversing switchgear was immersed in a tank which held about 100 gallons of oil, and this oil had not required changing for 18 months. A 150-H.P. motor stator reversing switchgear supplied by the same maker had only about three gallons, but it required changing at least every month, which added considerably to the maintenance cost. The operations of the 350-H.P. motor were about four to one of the 150-H.P. motor. The following figures were obtained at a South Wales colliery where electricity was the sole motive power. It had an output of 5,120 tons a week, but the output was increasing rapidly, and with very little extra current consumption. The time of working was from 2 p.m. Saturday to Saturday in the following week. The generating plant consisted of high-pressure impulse-type turbo-alternators (with condensing plant), 3,300 volts, three-phase, 50 cycles. The steam was generated in Lancashire boilers fired with anthracite coal, and the steam was superheated. During one week the total units generated were 48,800, with a consumption of 84 tons of coal—that was to say, 581 units per ton of coal. Of this output only 36,829 units were used at the colliery, the various applications being as follows :—

	Total units for week.	Units per ton output.
Ventilation	20,160	3·94
Pumping	1,266	0·247
All surface and underground lighting, lamp-cabin motors for cleaning and charging accumulators	456	0·089
Screening	2,357	0·46
Haulage	6,042	1·18
Winding*	6,548	1·279
	36,829	7·195

* This should work out less in shaft winding on account of balance load.

The underground haulages were all main-and-tail, and all the coal was collected from the various districts and concentrated at the drift bottom. It was then taken up the drift, which was 500 yards long, having a gradient of 1 in 3. The total ton-mileage including winding was 6,550·5 ton-miles, and the units per ton-mile for haulage and winding worked out at 1·92.

The fifth annual meeting of the members of the South Wales Branch will be held at the Castle Hotel, Neath, on Saturday, May 9th, at 4.30 p.m., when the branch president, Mr. Godfrey H. Williams, will deliver his presidential address, supported by the Association president, Mr. Alex Anderson, and other gentlemen. At the close of the meeting the members will dine together.

Birmingham and District Electric Club.—On April 18th, Mr. E. A. Hildage read a paper on "The Selection of Chain Gearing." He stated that the chief factors affecting the question of chain gears were power, speed, gear ratio, the position of the drive, the distance between the shafts, and the direction of rotation. Much valuable information was given of the design of chain drives, and convincing examples showing the savings in power and increased efficiency were given and illustrated by lantern slides. The importance of adequate lubricating arrangements, and the advisability of gear cases where possible, were emphasised, as affecting the life and satisfactory running of the chain. Figures were submitted showing that in many cases the first cost of a chain drive was lower than that of a belt or rope drive, while the life of a chain was invariably greater than the life of ropes or belts.

The Concrete Institute.—A paper was read by Mr. Oscar Faber, B.Sc., entitled "The Design of Steel and Reinforced Concrete Pillars, with Special Reference to Secondary and Accidental Stresses," at the meeting on April 16th.

Electricity in Poultry Cultivation.—Experiments carried on by Mr. Randolph Meech at Poole, during recent months, with a system of Mr. Thorne Baker, on some thousands of chickens, indicate that electrical treatment accelerates growth by about 50 per cent.; at the same time the mortality amongst the young birds is greatly reduced, and their appetite is lessened. The system consists in the application of intermittent positive electrical discharges together with a high-frequency alternating field.

Faraday House Scholarships.—At the recent examination for entrance scholarships held at Faraday House Electrical Engineering College, Mr. W. G. Radley, of Leeds Modern School, was awarded the Faraday Scholarship of 50 guineas per annum, tenable for two years in college and one year in works, and Mr. C. H. B. Ewbank, of Epsom College, the Maxwell Scholarship of 50 guineas per annum, tenable for one year in college and one year in works.

Tramway and Light Railway Congress.—The preliminary programme has just been issued in respect of the eighteenth annual International Tramways and Light Railway Congress, which is this year to be held in Buda-Pesth. A large number of reports are, as usual, to be presented to the gathering, among them being the following :—M. Duval-Arnould, of the Paris Municipal Council, and Dr. Kuhles, of the Munich Municipal Council, will deal with (*a*) The Influence of New Means of Transport on the Development and Extension of Large Cities; and (*b*) Tramway and Suburban Railway Fares, Reduced "Correspondence" Tickets, and their Influence on Receipts; and Season Ticket Rates and Systems for their Calculation. Herr Busse, the chief engineer of the Berlin tramways, and M. Resal, manager of the Bordeaux tramways and omnibuses, will report on the subject of the Undulatory Wear of Rails. M. Bacqueyrisse, tramway engineer to the Paris General Omnibus Co., and Signor Minorini, manager of the Milan Municipal Tramways, will deal with the subjects of the Best Shape of Rails and Tires to give a Minimum Traction Coefficient, and least Wear of Rails on Curves; the Influence of Wheel Base on Curves; and the Use of Manganese-Steel Rails. The question of the Economy of Energy due to the Use of Ball and Roller Bearings on the Axles of Electric Tramway and Railway Vehicles will be reported upon by M. Largiader, manager of the Zurich Tramways, Herr Schoerling, manager of the Hanover Tramways, and Herr Tobias, manager of the tramway works in Buda Pesth. M. Noirfalise, general manager of the Liége Tramways, will deal with the questions of the Training of Motormen (Drivers), Conductors and Checkers, the Methods of Issuing Bundles of Tickets to Conductors, and the Handing Over of the Receipts. A report on the Special Provisions necessary on the Wagons of Narrow-Gauge Railways to Facilitate the Transfer of Goods to the Rolling Stock of Standard-Gauge Railways, will be presented by M. Sapin, managing director of the Compagnie Centrale de Chemins de Fer et Tramways Electriques, of Paris. M. Sekutowicz, of Lyons, will deal with the question of Underground Electric Feeders, especially as regards the Requirements of Armoured Cables, the Use of Aluminium as Conductors, and the Life of Underground Cables. Herr Sieber, manager of the Nuremburg-Furth Tramways, will take up the subject of using a Higher Voltage for Suburban Tramways than for those in Towns, while Mr. Dalrymple, of the Glasgow Corporation Tramways, and M. Sarrat, of Brussels, will report on the question of the Advantages and Drawbacks of the Various Systems of Converting High-Tension Alternating Current to Continuous Current.

Electrical Enterprise in Norway.—The two largest electrical concerns in Norway are the Rjukan Co. and the Aura Co., of which the latter is making arrangements for harnessing between 250,000 and 300,000 H.P. It is now reported by our Norwegian correspondent that Mr. Blakstad, the director of the Aura Co., is working on another scheme, which will be a good third in regard to size. About 10 years ago, Mr. Blakstad acquired all the water-rights of the Toke River, which flows through the western part of Telemarken in the south of the country, and thus through the same district as Rjukan. As soon as the titles had been secured, the river was surveyed and plans were prepared in due course, which resulted in an application to the Government for a concession about four years ago. This application was, however, withdrawn owing to certain political difficulties. The regulation of the whole river is first of all dependent on the regulation of the Totakoand, which is a lake, from which the river comes. The Toke River has at the present time to pass around a large mountain, the Eidsborgfjeld, which lies at the upper end of a valley, through which it flows later. It is now according to the plans the intention of altering the course of the river by leading the water through a tunnel through the Eidsborgfjeld. At the end of this tunnel the water will enter huge pipes, which are going to be laid along the very steep hillside, and will thus be conducted direct to the power station, which is to be erected at the foot of the mountain, and for which the necessary site has been acquired. This represents the most important fall of the river, but there is still a fall of several hundred metres to be reckoned with further down, which also can be utilised, and the total quantity of power can thus be brought up to anything between 250,000 and 300,000 H.P. Owing to the mountainous character of the country the district itself offers no opportunity for the erection of manufacturies, as the transport of the products to and from these would be very difficult. The power, therefore, cannot be employed on the spot as at Rjukan, hence it is the intention to transmit it to the coast, the main portion of it most probably to Skien, which is the shipping port of the products from Rjukan and will no doubt become a great industrial centre. It is assumed that the energy will chiefly be used for electro-metallurgical purposes.

Under the name of Aktieselskapet Höiangsfaldene, a company was formed some time ago for the purpose of acquiring the water rights of the Höiangsfaldene, with the view of harnessing the falls, which are situated in the neighbourhood of Bergen, and are estimated to be able to produce in all 70,000 E.H.P. The company has now submitted an application to the Government for a concession. In the first instance, it is the intention only to make use of about one-third or one-fourth of the whole amount of power available; the remaining portion will come into question later on. The power to be produced by the preliminary installation is to be employed for the electrical smelting of iron-ore, and the ironworks to be built is later on to be supplemented by a steelworks, in which the products of the ironworks can be turned into steel. All the shares of the new company are in Norwegian hands, and the promoters of the enterprise are men of good financial standing, who are chiefly engaged in the shipping and whaling business.

Late Legal.—J. & R. Oldfields, Ltd., *v.* Electric Battery Co.—By this action, which was heard by Mr. Justice Neville in the Chancery Division on Wednesday, April 22nd, the plaintiffs, a Birmingham firm, sought relief in respect of an alleged infringement of their catalogue by the defendants, who carried on business in London.

From the opening statement of Mr. Butcher, K.C., who represented the plaintiffs, it appeared that towards the end of 1911 they had prepared for them a catalogue with a description of their electric lamp, which catalogue was largely circulated amongst the public and the trade. In June, 1912, a further catalogue was issued, containing descriptions of other things besides electric lamps, but retaining the original description and advertisement of the lamps. The copyright of both catalogues was now vested in the plaintiffs. In February, 1913, they discovered that the defendants had printed and circulated a catalogue of their E.B.C. dynamo and electric lighting installations, which contained a description of an electric motor-car lamp which, it was alleged, was copied from, or was a colourable imitation of, the description of the lamp in the plaintiffs' catalogue. The plaintiffs' lamp, said counsel, was described as a lamp into which "no dust could enter . . . owing to a tightly fitting flange." In the defendants' catalogue they had "highly fitting flange" instead of "tightly." Counsel called attention to a number of other similarities, and said that so far as they could find, no other manufacturer had used the same descriptive language as was found in the plaintiffs' catalogue. It was significant also, he said, that the defendants had published a previous catalogue in which different language was used, and it would appear, he submitted, that the plaintiffs' language being much more attractive than the defendants', the latter had abandoned their own and used the plaintiffs'.

Mr. Woodgate, for the defence, denied that the defendants' catalogue was in any way copied from the plaintiffs' and called evidence in support of that contention.

Without calling upon plaintiffs' counsel to reply, his Lordship gave judgment for them, with 40s. damages and costs.

Adventure of a Motor.—The British Thomson-Houston Co., Ltd., of Rugby, supplied one of their DG type motors to Messrs. A. & F. Manuelle, of Guernsey, some six months ago; this machine was coupled to a pump, and was mounted with it on a combined baseplate. On being unloaded from the ship at Guernsey, the combined set was deposited on the top of a stack of timber on the quay. Owing to the action of a strong wind, and also probably to faulty stacking of the timber, the whole pile collapsed, and the machines were precipitated into the sea. The height from the quay to the sea floor at this point is 30 ft., and the water at high tide attains a depth of about 20 ft. It was impossible to recover the machines until low water, so that in addition to the effects of the impact on the sea floor, the motor was subjected to the action of sea water, at a considerable pressure, for a matter of half a day. When recovered, in addition to a bent shaft, the motor was found to have one foot broken off, and the endshield at the commutator end cracked through. As the machine appeared to be electrically in good condition with the exception of the wetting, Messrs. Manuelle proceeded to repair the mechanical defects. The cracked endshield was patched, a wrought-iron foot was fitted, and the armature shaft was straightened, as far as was practicable, in a lathe. The motor was then reassembled and the set installed. No dressing of any sort was applied to the windings, and the machine was left to dry itself out in service. In spite of the fact that the shaft is still slightly sprung the motor has been running satisfactorily ever since it was installed, and although the supply pressure is 420 volts, no leakage of current is perceptible. This happy result speaks well for the methods used by the makers for insulating the windings of their machines, the cotton covering of the conductors being thoroughly impregnated with insulating varnish, and all the material used of the highest quality. The ability to survive so serious an accident is an excellent testimonial to the merits of the electric motor.

Marylebone Battery Arbitration.—The following letter reached us after our "Correspondence" pages were closed:—

"Referring to the note which appeared in your issue of 10th inst. regarding the battery at Rathbone Place belonging to the Marylebone Borough Council, where it is stated that this company was not disposed to carry out the necessary work, I shall be much obliged if you will afford me space to state that the question at issue with the Corporation is whether the further repairs which are necessary to the battery, and which are to be carried out by this company, are to be borne by the Corporation or the company.

"It has been mutually agreed to appoint an Arbitrator to decide the question of payment.

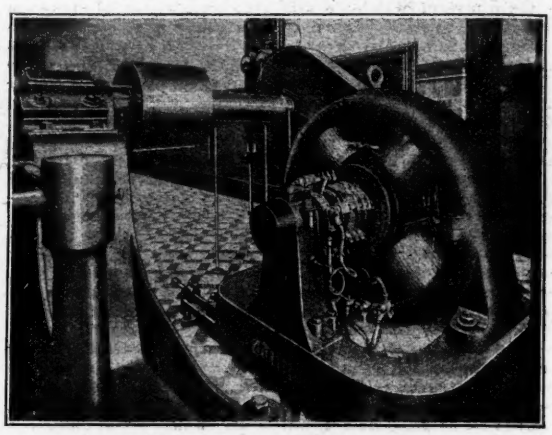
"Electrical Power Storage Co., Ltd.

"Malcolm Leggett, *Secretary.*

"London, E.C., *April 22nd*, 1914."

Appointments Vacant.—Switchboard attendant (20s. to 25s.), for Erith; jointer, for Blackburn Corporation electricity department; switchboard attendant for Dundalk electric supply undertaking (25s.); assistant mains engineer (250 taels, or £30 per month), and mains foreman (200 taels, or £25 per month), for Shanghai Municipal Council. Particulars are given in our advertisement pages.

A Mill Lighting Plant.—A typical example of mill lighting plant is shown in the accompanying view which represents a General Electric dynamo of 30 kw., 220 volts, installed at the Leigh Manufacturing Co.'s sheds under the direction of



Chain-driven G.E.C. Dynamo.

Mr. R. S. Greenhalgh, of Atherton. This machine is driven from the main shaft of the mill engine through a Hans Renold chain, and is situated in the engine house. We understand that electricity is being generated at a cost of 6d. per unit, including interest and depreciation.

Strengthening Foundations.—According to the *Times*, grouting experiments which have been in progress at the old Post Office site, with a view to determining the possibility of strengthening the foundations of St. Paul's Cathedral by injecting liquid cement into the subsoil, have been successful. A number of borings have been made, and the liquid cement has been forced into them by compressed air. The cement has permeated the subsoil for a considerable distance round each of the borings; and not only gravel and sand, but also clay has been transformed into a solid concrete mass. It is probable that the process will now be applied to the subsoil under St. Paul's Cathedral. The process may be found useful by engineers who find the foundations of buildings under their charge in an unsatisfactory condition.

Charging Batteries from A.C. Supply.—A correspondent, one of whose clients requires a supply of current for charging purposes, finds that a motor-generator would not be suitable for this, and would like to know whether any reader has found some standard apparatus which is satisfactory for charging batteries from an alternating-current circuit with a frequency in the neighbourhood of 80.

Electric Smelting of Iron Ore.—According to an article published in the *Canadian Mining Journal*, a company at Toronto has evolved a type of electric furnace specially adapted for the smelting of Canadian magnetite iron ores. The metal produced is said to be very sound and fluid, and when used for steel casting gave very clean surfaces, such as are ordinarily obtained only in grey iron castings.—*Board of Trade Journal.*

For Sale.—Ayr T.C. have for disposal one 100-k.v.a. Siemens alternator, direct-coupled to a Marshall horizontal engine. Particulars are given in our advertisement pages.

Correction.—With reference to the paragraph published on page 619 of our issue of April 10th respecting an electric lighting scheme for Bawtry, by an inadvertence our correspondent stated that the scheme was being provided by Messrs. Best and Turner, of Bradford. The partnership between Messrs. Best and Turner was dissolved in August, 1912. For the Bawtry scheme Mr. C. H. Best has as his colleague, Mr. C. Pullan, electrical engineer, of Bradford.

Educational Note.—Goldsmiths' College, New Cross. Eight special lectures on Wireless Telegraphy are to be given during May and June, as announced in our advertisement pages to-day.

International Electrotechnical Commission.—At the Berlin meeting of the I.E.C. held in September, 1913, an account of which appeared in our issue of September 19th, it was agreed that meetings of the (International) Special Committees should be held in Madrid towards the close of the present month. These Special Committees deal with symbols, standardisation rules for electrical machinery, nomenclature and prime movers for electrical plant. It has, however, been found impracticable to hold these meetings at the present time, and they have, therefore, been postponed until the autumn. It is probable that they will take place in London.

Publication 28 of the I.E.C. International Standard of Resistance for Copper, has recently been issued and should prove of considerable interest to the electrical industry. We will refer to it more fully in a later issue. It can be obtained from the General Secretary of the I.E.C., 28, Victoria Street, Westminster, S.W., by sending a P.O. for 2s. 1d.

Sixteenpence for Fourpence.—The following passage which occurred in an Editorial note in our esteemed contemporary, the *Electrician*, last week gives food for furious thought: "According to Mr. Clarkson, the fuel cost for a 3-ton petrol-driven vehicle is 2d. per car-mile with petrol at 1s. 4d. per gallon. With coke at 19s per ton, the fuel cost of a steam-driven vehicle of the same capacity is 0·4d. per mile. This is equivalent to saying that when petrol is at 1s 4d. a gallon, and coke at 19s. per ton, the fuel costs of the two types of vehicles are equal."

In other words, the greater is equal to the less, and much study is a weariness to the flesh. The solution of the mystery, after all, appears to be fairly obvious. Our contemporary has been reading some of the veracious circulars in which it is proved that electricity at 4d. a unit costs as much as gas at 14s. per 1,000 cb. ft., and the figures have got mixed.

International Electrical Congress.—We understand that Mr. A. G. Collis, who has made a special study of switchgear, has been invited to read a paper at the Congress in San Francisco next year, and has chosen for his subject "The Effects of Rupturing A.C. and D.C. Circuits."

Annual Dinner.—The employés of the West Ham Corporation electric supply department held their fifth annual dinner on Saturday, April 4th, Mr. J. W. Beauchamp (engineer and manager) presiding over a company numbering over 60. The dinner took place at the Princess Alice Hotel, Romford Road.

Radium Frauds.—In view of the popular demand for radium treatment, the Medical Committee of the British Science Guild has issued a warning as to the danger that the claims made for radium as a curative agent may lead to the fraudulent sale of substances alleged to contain radium, or to harmful treatment by unqualified persons.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — MR. W. A. STREET, district superintendent on the sales department of the borough of St. Marylebone electric supply, is resigning his position in order to join the Sturtevant Engineering Co., London.

MR. H. GREGG, late mains engineer to the Woking E.L. Co., has been presented by the staff with a gold signet ring bearing his monogram.

MR. H. ORFORD has resigned his position as senior shift engineer with the Kidderminster and District Electric Lighting and Traction Co., to enable him to take up similar duties at Messrs. Mitchell and Butler's power station, Birmingham.

MR. WM. SILVERWOOD, of Heckmondwike, has been appointed works fitter at the Lancaster Corporation Electricity Works, in succession to Mr. T. W. Hudson, who has been appointed to a post under the Yorkshire Electric Power Co.

General.—MR. W. G. WATSON, of Sydney, who has been in Europe for the past nine months, leaves for Australia *via* America in the course of a week or two.

With reference to our article of last week describing the hydro-electric installation for working the mines of the Tekkah Mining Co., Perak, Malay States, we learn that this plant was installed under the direction of the late MR. O. F. DOMON, M.I.E.E., of the Oerlikon Co. Mr. Domon unfortunately died out in the Malay States as the victim of fever contracted in the forest during the putting up of the transmission lines.

MR. ALFRED W. BEUTTELL has removed to 109, Victoria Street, Westminster, S.W.

The *Manchester Courier* states that MR. J. N. PRING, who is attached to the department of Physics in Victoria University, occupying the position of lecturer and demonstrator in electro-chemistry, has been nominated to a "table" at the Mosso Laboratory, which is situated at a high altitude on Monte Rosa. At this centre he will engage in investigations relative to the conditions of the upper atmosphere. Mr. Pring has received a grant of money from the Royal Society to aid his research work on Monte Rosa.

The *Review of the River Plate* states that MR. ERNESTO NEWBERY, hitherto sub-director of municipal lighting and electrical installations, Buenos Ayres, has now been named director in succession to his brother, the late Mr. George Newbery.

The British Electrical Friendly Society held the ninth annual dinner of the Potteries District of the Society on 16th inst. Mr. W. Thom, general manager of the Potteries Electric Traction Co., presided. Mr. G. C. Kent proposed "Success to the British Electrical Friendly Society." Subsequently Mr. Cornwallis West, acting for the members, presented an oak bureau to MR. WASHINGTON HALL, in recognition of his services as secretary.

The marriage took place, at Holy Trinity Church, Rugby, on April 11th, of MR. JOHN R. BLYTH, of the staff of the British Thomson-Houston Co., Ltd., Rugby, and Miss I. Batson, only daughter of Mr. G. Batson, of London.

The marriage took place, at Tabernacle Church, Aberayron, on April 11th, of MR. ENOCH GORDON LLOYD, electrical engineer, of Charlton, London, and Miss Margaret Caroline Evans, granddaughter of Capt. David Lewis, of Glendower, Mydrollyn.

NEW COMPANIES REGISTERED.

Park Royal Engineering Works, Ltd. (135,281).—This company was registered on April 17th, with a capital of £20,000, in 19,800 preference shares of £1 each and 14,000 ordinary shares of 1s. each, to carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in electrical apparatus, &c., at Park Royal, Middlesex. The subscribers (with one preference share each) are:—H. H. Konig, 1, St. Michael's Alley, Cornhill, E.C., merchant; H. M. Bayly, 20, Addison Road, Bedford Park, Chiswick, electrical engineer. Private company. The number of directors is not to be less than three or more than seven: the first are H. M. Bayly, G. J. L. Nicholson and A. G. Morrish. H. H. Konig may, while holding £1,000 shares or debentures, nominate a director. Qualification, 100 preference or ordinary shares; remuneration, £100 each per annum. Registered office, 31-36, Gresham Street, E.C.

W. T. Cornell, Ltd. (135,199).—This company was registered on April 9th, with a capital of £800 in £1 shares, to carry on the business of manufacturers of electrical and gas fittings and stoves, motors, internal and external combustion engines, electrical accessories bicycles, &c. The subscribers are:—Mrs. S. Cornell, 8, The Pavement, Northwood 200 shares; W. Cornell, 8, The Pavement, Northwood, electrician, 5 shares; Miss S. L. Cornell, 8, The Pavement, Northwood, 1 share; Mrs. L. F. Cornell, 8, The Pavement, Northwood, 1 share; A. Cornell, 45, Durban Road, Tottenham, 1 share; F. Cornell, 25, King's Terrace, Hounslow, electrician, 1 share; H. Cornell, 27, Fame Park Road, Putney, painter. Private company. The number of directors is not to be less than two or more than five: the first are Mrs. S. Cornell and W. Cornell; qualification, five shares. Registered office, 8, The Pavement, Northwood, Middlesex.

Scottish Welding and Electrical Co., Ltd. (9,073).—This company was registered in Edinburgh on April 6th, with a capital of £1,000 in £1 shares, to carry on the business of electrical engineers, motor and motor-car manufacturers, &c. The subscribers (with one share each) are:—J. J. Weldon, 135, Wellington Street, Glasgow, manufacturer; G. Smith, 142, Kennedy Street, Glasgow, electrician. Private company. The number of directors is not to be less than two or more than seven; the first are J. J. Weldon and G. Smith; qualification, 50 shares; remuneration £25 each per annum. Registered office, 135, Wellington Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bagdad Tramways and Electric Lighting Syndicate, Ltd.—Particulars of £15,800 debentures, created February 24th, and secured by trust deed dated April 2nd, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and shares in a Turkish company to be formed. Trustee: H. T. Barnett, B.A.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £600 on February 18th, 1914, of charge dated March 18th, 1911, securing £60,000, has been filed.

Preston Portable Battery and Lamp Co., Ltd.—Debenture dated March 16th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Morum Brothers, 18, Aldermanbury, E.C.

Electric Sign Co., Ltd. (45,610).—Capital, £5,000 in £1 shares. Return dated March 17th, 1914. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd.—A memorandum of satisfaction to the extent of £5,196, on February 4th, and £875 on April 1st, 1914, of deb. stock dated February 1st, 1906, December 22nd, 1908, and November 5th, 1913, securing £250,000, has been filed.

Rushden and District Electric Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 28th, 1914, to secure all moneys due, or to become due, from the company to Northamptonshire Union Bank, Ltd.

Northampton Electric Light and Power Co., Ltd.—Issue on March 14th of £250, on March 21st of £500, on March 28th of £250, and on April 1st, 1914, of £300 debs., part of a series of which particulars have already been filed.

Llangefni Electric Light and Power Co., Ltd.—Particulars of £1,200 debs., created March 27th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Freehold property known as The Mill, Llangefni. No trustees.

Boardman & Garstang, Ltd.—Debenture, dated March 16th, 1914, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. J. Boardman, 109, Bold Street, Fleetwood, Lancs.

Cambridge Electric Supply Co., Ltd.—Capital, £100,000 in £10 shares. Return dated March 11th, 1914; 9,792 shares taken up; £9 per share called up; £88,128 paid. Mortgages and charges: £30,000 first debentures; also debentures with bankers to cover £15,000 (£12,000 outstanding at date of return).

Hobart Manufacturing Co. (1,350 F).—Particulars filed March 31st; capital, $1,600,000 in $100 shares; registered in Troy, U.S.A., on March 12th, 1913 to manufacture and deal in motor-driven machinery and other electrical and mechanical machinery and devices, &c. British address: Hobart House, Charterhouse Street, E.C. J. J. McIntyre, of 401-3, Birkbeck Chambers, Holborn, W.C., is authorised to accept service.

Clarke, Chapman & Co., Ltd. (39,045).—Capital, £250,000, in 18,400 ord. and 7,000 pref. shares of £10 each. Return dated March 18th, 1914. 15,251 ord. and 6,985 pref. shares taken up. £10 per share called up on 3,536 ord., £2 10s. on 200 ord. and £10 on 4,435 pref. £80,210 paid. £142,450 considered as paid, being £10 per share on 11,545 ord. and 2,550 pref., and £7 10s. per share on 200 ord. Mortgages and charges: £100,000.

Gell Telegraphic Appliances Syndicate, Ltd. (78,405).—Capital, £40,000, in £1 shares. Return dated January 28th, 1914. 37,700 shares taken up. 10s. per share called up on 15,000, and £1 per share on 7,700. £15,537 10s. paid, including £337 10s. on 1,500 shares forfeited. 10s. per share considered as paid on 15,000. Mortgages and charges: £1,600.

Cambridge Electric Tramways Syndicate, Ltd. (79,744).—Registered January 14th, 1914. Capital, £5,000 in £10 shares. Return dated February 21st, 1914. 107 shares taken up. £9 0s. 4d. per share called up on 90. £10 per share on 10 and nothing on 7. £911 12s. 1d. paid. Mortgages and charges: Nil.

H. J. Cash & Co., Ltd. (79,701).—Capital, £10,000 in £1 shares. Return dated March 3rd, 1914. All shares taken up. 17s. 6d. per share called up. £8,750 paid. Mortgages and charges: Nil.

English Electrical Co., Ltd. (112,639).—Capital, £5,000 in £1 shares. Return dated March 9th, 1914, 526 shares taken up, £526 paid. Mortgages and charges: £10,000.

Float Electric Co, Ltd. (107,336).—Capital, £10,000 in £1 shares. Return dated December 31st 1913 (filed February 16th, 1914), 1,005 shares taken up, £1,002 paid, leaving £3 in arrears. Mortgages and charges: £9,850.

St. James's and Pall Mall Electric Light Co., Ltd. (26,015).—Capital, £300 000 in 20,000 pref. and 40,000 ord. shares of £5 each. Return dated March 3rd, 1914. All shares taken up. £5 per share called up on 20,000 pref. and 33,650 ord. £598 250 paid. £1,750 considered as paid on 350 ord. Mortgages and charges: £150,000 3½ per cent. deb. stock and £239,900 guaranteed deb. stock of the Central Electric Supply Co., Ltd., being half the total loan capital.

Scarborough Electric Supply Co., Ltd. (37,569).—Capital, £100,000 in £10 shares. Return dated March 14th, 1914. All shares taken up. £100,000 paid. Mortgages and charges: Nil.

Electric Wiring and Fittings Co., Ltd. (29,676).—Capital, £5,000 in £1 shares. Return dated February 25th, 1914. 1 382 shares taken up. £1,375 paid, leaving £7 in arrears. Mortgages and charges: Nil.

Charing Cross, West-End and City Electric Supply Co., Ltd. (29,123).—Capital, £2,100,000 in £5 shares (180,000 pref., 180,000 ord., 80,000 City undertaking pref., and 80,000 City undertaking ord.). Return dated March 12th, 1914. 80,000 pref., 80,000 ord., 80,000 City undertaking pref., and 70,000 City undertaking ord. shares taken up. £5 per share called up on the pref., ord., and City undertaking pref. £1,200,000 paid. £850,000 considered as paid on the City undertaking ord. Mortgages and charges: £1,087,178.

Sun Electrical Co., Ltd.—A memorandum of satisfaction to the extent of £275, on March 31st, 1914, of deb. stock dated March 31st, 1911, securing £7,000, has been filed.

Hindhead and District Electric Light Co., Ltd.—Issue on March 30th, 1914, of £50 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Woking Electric Supply Co., Ltd.

The directors report that the total revenue for the year ended December 31st, 1913, was £17,874, less cost of generation and distribution of electricity and management £9,752, leaving £8,122 plus £596 brought forward, and income-tax accumulations £140, making a total of £8,858. Of this sum there have been paid:—Interest on debenture stock, £2,383; interest on temporary loans, £566; dividend on 6 per cent. cumulative preference shares, £2,609; leaving £3,300. Out of this it is proposed to put to credit of depreciation and renewals fund £1,250; reduction of cost of provisional order, fire appliances, debenture issue expenses, share prospectus expenses and cost of office furniture, £168; reduction of cost of free wiring, £66; placing to a reserve account £350; paying a dividend of 4 per cent. on the ordinary shares, £843; and carrying forward £622.

	No. of consumers.	Lamps connected.	Revenue.
1911	1,628	70,710	£14,134
1912	1,761	79,717	£15 668
1913	1 901	88,143	£17,584

The directors have issued £2,470 4½ per cent. debenture stock, and £2,002 6 per cent. cumulative preference shares during the year. Owing to the continuous growth of the business, the directors are still looking towards issuing further debenture stock, and preference and ordinary shares. The expenditure on capital account at December amounted to £135,693. During 1913 2¾ miles of cable were laid. As shown above, the directors have placed £1,250 to the credit of depreciation and renewals fund account, which now stands at £13,520, and they have also opened a reserve account, to the credit of which they have placed £350 out of the year's profits.

Continental.—Norway.—It is reported that a new company is being formed to acquire the Högfossene Waterfalls situated in Treungen in Telemarken, which are estimated to yield about 25,000 H.P. when harnessed. The electrical energy will be transmitted to the town of Risör on the coast, where the promoters have an option for the purchase of large sites, suitable for building and shipping purposes. The harnessing of the waterfalls and the construction of the power station will involve a capital expenditure of more than £200,000.

It was recently reported that a Swiss company had made a contract for 10,000 H.P. per year, which are to be supplied by the Skiensfjord Power Co., from the Aarlifos, as soon as the works with the harnessing of same are completed. A Norwegian company has now been registered in the town of Porsgrund, a few miles distant from Skien. It is said to be intended to employ the energy for steel smelting, for which purpose the necessary sites at Porsgrund for the erection of a steel works have been acquired. The capital is fixed at £14,000, and the directors are Advocat Knagenhjelm, Engineer A. Christiansen, both Norwegians, and Engineer Ullman, a Swiss citizen.

Hungary.—Messrs. Ganz & Co., of Buda-Pesth, report a profit of £34,251 for the last financial year. The dividend is being reduced from 7 to 6 per cent.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2½ per cent., being at the rate of 10 per cent. per annum for the quarter ending 30th inst.

Weston-super-Mare and District Electric Supply Co., Ltd.

Mr. G. J. Somerville (Chairman) presided on April 15th, at the offices of the Electrical Federation, Kingsway, over the 16th ordinary general meeting.

The Chairman, in moving the adoption of the report, said the year had been a good one and the dividend on the ordinary shares was an increase from 2½ per cent. to 4 per cent. The progress made during the current year was atisfactory and the three days' holiday traffic was £29 in excess of the three days of last year.

Mr. E. R. Soames seconded the motion and the report was adopted.

The directors' report showed that the total capital expenditure at 31st December amounted to £129,856. The working accounts for the year showed a credit balance of £5,142 from electricity supply, £5,264 from traction, and £54 from sundry receipts, making a total of £10,460. Deducting administration and general expenses, £1,483, debenture and other interest, £2,310, and placing £1,500 to renewals account, there was a balance of £5,167, which with £425 brought forward made a total of £5,592. The directors propose to place to reserve account £1,000, to amount written off "commission and discount on shares and debentures issued" account £390, to dividend on the 6 per cent. preference shares £2,400, to dividend at the rate of 4 per cent. on the ordinary shares £1,400, carrying forward £403.

The installations connected to the mains at 31st December, 1913 (excluding the traction section), represented the equivalent of 37,125 lamps of 8 C.P., an increase of 2,475. The number of consumers during the year increased from 456 to 505. The total revenue for the year showed an increase of £595, and the expenses an increase of £99, the net result being an improvement of £495. The gross receipts from the traction section amounted to £8,824, showing an increase of £1,597 compared with the previous year, due principally to the favourable summer weather. The expenses amounted to £3,560, leaving a balance of £5,264, an increase of £1,373 compared with 1912. The units sold were 566,270 as compared with 493,534 in 1912; and the tramway passengers carried were 1,342,753 as compared with 1,115,265, the receipts per passenger improving from 1.50d. to 1.54d. There are 12 cars and the route mileage is 2.92 m.

Taunton Electric Traction Co., Ltd.

Mr. G. J. Somerville (Chairman) presided on April 15th, at the offices of the Electrical Federation, over the eleventh ordinary general meeting, when, on the motion of the Chairman, seconded by Mr. Stagg, the following report was formally adopted:—

During the year £18 3s. 3d. has been expended on capital account which, at December, 1912, stood at £31,200. The total receipts for the year, including £32 brought forward, amounted to £2,776, and after deducting all expenses, debenture interest and a provision of £100 for renewals, there is a balance of £30 to be carried forward.

	1912.	1913.
Miles Open—		
Route Miles	1.66	1.66
Single Line	1.31	1.31
Double Line	0.35	0.35
Passengers carried	581,286	660,356
Average Receipts per Passenger	0.99d.	0.94d.
Average Expenditure per Passenger	0.98d.	0.90d.
Proportion of Expenses to Receipts, per cent. ...	99	96
Cars in Stock	6	6

Johnson & Phillips, Ltd.—The directors' report for the year ended December 31st, 1913, states that the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £7,000 for maintenance of buildings, plant, &c., amounts to £33,176 plus £3,315 brought forward. The following are to be deducted:—Remuneration of directors, auditors' and trustees' fees, £1,853; interest on debenture stock to December, 1913, £6,440; reserve re debenture sinking fund, £6,477; interest on second debentures to December, 1913, £2,500; depreciation on machinery and plant, &c., £6,156; interest on loan, £309; carrying forward, £12,755. The annual meeting was held yesterday.

United River Plate Telephone Co., Ltd.—The directors recommend a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend 8 per cent. for the year, leaving to carry forward £6,357.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 4 per cent. per annum for the six months ending March 31st, 1914, payable May 1st.

Rees Roturbo Manufacturing Co., Ltd.—According to a financial daily the accounts for 1913, after providing for interest on loans, show that a credit balance of £487 brought forward was increased to £2,539, which is to be carried forward.

Marconi Wireless Telegraph Co., of America.

The annual meeting of this company was held in Jersey City last Monday. The balance sheet for eleven months ending December 31st, 1913, then submitted showed a surplus of $178,251. It was necessary to make very large and unusual expenditures during the year, but it is confidently expected that the extraordinary conditions which called for them will not occur again. In round figures these expenditures aggregate over $60,000. Further, a large number of orders which remained open at the end of the year could not be included in the account, because while they showed a profit this had not then been definitely ascertained. Since the close of the year the majority of the orders have been filled and profits assured for the current year. The directors state that the erection of the high-power long distance stations is progressing, and unless unforeseen circumstances arise they should be completed and open for business early in the summer. A combination of circumstances prevented earlier completion. "Entirely new construction problems had to be dealt with, new apparatus and new equipment designed and fabricated. We have been very seriously delayed by the manufacturers, who failed in some cases to furnish apparatus and equipment in time, and in other cases the machinery, etc., when completed failed utterly to stand the tests which we required, necessitating its being rebuilt. The bad weather, which prevailed throughout, also seriously interfered with the erection of steel towers; and altogether, many things conspired to retard our plans. As to the Pacific Stations, everything seems favourable to our being able to start service with Honolulu prior to June 1st. Nothing much has been done in regard to our proposed Philippine Station because of many obstacles which have been placed in the way of our securing concessions and rights from the United States and Insular Governments. A bill, however, has just been passed by the Philippine Assembly, granting us, subject to the approval of the Secretary for War, the right to erect a high-power station which will work with Honolulu, Japan and China, and we hope at an early date to receive the approval of the War and Navy Departments enabling us to proceed with the work of location and installation. The Imperial Japanese high-power station, which is being constructed to work in connection with our Honolulu high-power station, is not yet completed. . . . . Land has been purchased at Chatham and Marion, Massachusetts, the former for a transmitting station and the latter for a receiving station, for high-power work with Norway. The Norwegian Government station also is now under way. Satisfactory arrangements have been completed with the Western Union Telegraph Co. under which connection will be made between its main operating rooms in New York, San Francisco, Boston, etc., and our new high-power stations in New Jersey, California and Massachusetts. These wires will be equipped with the latest devices for direct and expeditious exchange of traffic. Inasmuch as we shall be in competition with the Western Union Telegraph Co., as well as all other cable companies, for trans-Atlantic business, it will be necessary not only for us to influence patronage in our favour in all large cities, but we shall have to keep it coming. Therefore, a business-getting organisation has been perfected and representatives will be located in New York, Chicago, New Orleans and San Francisco, who will be in charge of a capable corps of canvassers which will keep in touch at all times with the cabling public and inform them of our superior facilities and reduced rates."

"This company is arranging to construct several high-power stations along the Alaskan Coast and in the interior, and steel has already been shipped for stations to be constructed at Ketchikan and Juneau for commercial business with Seattle and Astoria, Washington. There are good prospects for good business. We are in negotiation with the Cuban Government to take over and operate on a joint basis several wireless stations which that Government has been maintaining independently."

Indo-European Telegraph Co., Ltd.

The directors report that the carrying capacity of the company's system has been materially increased by the addition of a through wire from the Russo-German frontier to Teheran. This is linked up with a new wire through Germany, connecting with a corresponding new conductor in an Anglo-German cable across the North Sea, and will shortly be connected beyond Teheran with a new wire between Teheran and Karachi, to be provided by the Indo-European Telegraph Department. The necessary agreements with the British Post Office and with the German Government dealing with the above arrangements and with other matters are not yet concluded. The total cost of the erection of the additional wire falling upon the company is £62,500; of this sum £35,000 has already been set aside, and the directors have now written off out of reserve fund the outstanding balance of £27,000. Further funds have been provided for the development of the Galletti system of wireless telegraphy and telephony. During the year 1913 these amounted to £20,360, of which sum £5,860 is represented in the balance sheet by the holding in the Galletti Co., whilst £14,500 has been treated as a cash advance against the assets of that company. The directors propose to provide out of the year's profits £30,000 which will cover not only the cash advance above mentioned, but also the further sums which have been advanced up to the date of this report, leaving a margin. The company's revenue from message account and other sources amounts to £172,532, as compared with £183,411 for 1912, showing a decrease of £10,879. The expenses are, on commercial and general account £59,968, and on maintenance account £31,473, making a total of £91,441, as against £90,974 for 1912, an increase of £467. The revenue account therefore shows a balance of £81,091, which is carried to profit and loss account 1913, and after deduction of income tax paid is reduced to £74,802. To this is added the balance of profit for 1912 brought forward of £13,655, and £11,332 representing sundry balances which have accumulated during this and previous years and are now available, making a total of £99,789. Deducting £20,827 provided for depreciation of the company's securities to date and the interim dividend of £10,625, already paid, there remains a balance available for distribution of £68,336. The directors now propose to declare a dividend for the six months ending 31st December, 1913, of 17s. 6d. per share (making with the interim dividend already paid 6 per cent. for the year) and a bonus of 20s. per share, both free of Income Tax. They also propose to make the provision of £30,000 above referred to for the development of the Galletti wireless system, carrying forward £6,461 to the credit of 1914. They propose further to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of Income Tax. The directors report the death of Baron Joh. von Berenberg Gossler, of Hamburg, a director of the company for 35 years. Mr. Carl Joerger, of Messrs. Delbrück, Schickler & Co., Berlin, has joined the Board in the place of Mr. L. Delbrück of the same firm, whose death was reported last year.

Indian Electric Supp'y and Traction Co., Ltd.

The annual meeting was held on April 16th at the offices, Orient House, New Broad Street, Mr. J. G. B. Stone presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 627), said the gross receipts had risen from £8,499 to £10,161, and the balance carried to the balance sheet was £5,226 against £4,955 for 1912. Interest charges had risen from £2,608 to £3,600, owing to the whole of the new debenture stock now bearing interest. Since the date of the last report an additional £5,000 of debenture stock had been placed to provide further working capital, and to meet the growth of the company's business. It was anticipated that this expenditure would bring an adequate return to the company. They had practically concluded a contract with the municipality, under which they provided lamps, mains, etc., for an extended system of street lighting, and the supply of power for municipal purposes, and they waived all track rent for a period of fifteen years. Satisfactory terms had been arranged as to the revenue they were to receive from this source. During the past year the company had received no benefit from the economiser, condenser and new chimney, and consequently the consumption of coal on the existing plant had been excessive, thereby adding considerably to the cost of production. Since the accounts were closed, they had received advices from Cawnpore which already showed a considerable reduction in the amount of coal consumed per unit. The additions to the plant were now working, and they anticipated that there would be a further marked improvement in working costs resulting therefrom, apart from the ordinary expansion of the business. With regard to the short line of tramway which they worked, the position was practically unchanged, and they could see no encouragement to extend the system.

Mr. K. A. Scott Moncrieff, in seconding the motion, referring to the new plant which had been installed, said that as he anticipated would be the case when he addressed the shareholders last year, no benefit was shown in the present accounts. In fact they had been at a disadvantage because their business in Cawnpore increased so rapidly that they were compelled to work the boilers and other plant in an uneconomical fashion, and they actually did worse as regarded coal consumption in 1913 than in the previous year. From advices which they had received the result of the working of the new plant in the early part of the present year showed a marked improvement, but it would be a mistake if he were to attempt a forecast of what the actual result was likely to be for the year, because they had got to go through the hot weather, which, as regarded the condensing plant, was the most difficult time. With regard to the business in Cawnpore, he was pleased to say that it was showing a steady and regular increase. The total connections to the mains were now 57,580 30-watt lamps as compared with 45,507 for the year 1912; an increase of 26 per cent., which included an addition of 36 motors. The increase in units sold was 46 per cent., and 1912 showed a similar increase over 1911. The average price received per unit sold again showed a reduction—from 2.33d. to 2.05d.—a decline of 12 per cent., due to the increased output for power purposes compared with lighting. The result of their work in Cawnpore showed an increase in profit of 20 per cent., and there was no doubt that with the saving they expected to make in coal they ought to show an improvement on that figure for the current year.

The report was adopted.

Direct United States Cable Co., Ltd.

THE annual meeting was held at Winchester House, E.C., Sir JAMES PENDER, BART., in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., p. 667), said they had received the rents prescribed under their lease with the Western Union Co. and had paid a dividend at the rate of 4 per cent. per annum. They had suffered the misfortune of having had the main cable interrupted in deep water twice since the lease was entered into with the Western Union Co., and the cost of those repairs had amounted to a very large sum. As a result they had inserted a length of 425 miles of new cable of a much improved type, and the insertion of so long a stretch affected their reserve fund in this way—that it was possibly not so necessary to maintain the reserve fund at the same figure that they had aimed at in the past. At the same time, the directors had always held the view that it was in the best interests of the shareholders that the reserve fund should be maintained at such a figure that, should it be necessary, the main cable could be replaced at any time, and in pursuance of that policy, looking at the heavy expenditure of the last two years, they had felt it advisable to withhold the bonus that they had been able to recommend in previous years. They were hopeful that the main cable would not be again interrupted for many years to come, and that they would be able to resume payment of bonus. In the meantime he was confident that the shareholders would approve the policy of the board. The insertion of the new and better type of cable had materially improved its working capacity, and he was able to inform them that the traffic that was now being carried over the cables by the Western Union Co. was enormously in excess of that carried in previous years. Their reserve fund now stood at £451,490, of which roughly £373,000 was represented by investments and cash and £78,000 by cable on hand. The directors had thought it advisable to have a long length of cable manufactured in order that they might be prepared at any time to execute repairs that might be necessary without delay. They had an opportunity of obtaining that cable at a low price, and they believed it was their duty to put themselves in the position of being able to carry out the terms of their lease with the Western Union Co., and to effect repairs to the cables within as short a time as possible when they were interrupted. To do that they had to dispose of some of their investments, and in consequence of the depressed conditions of the markets they had to write off £5,971. As against that, however, it must not be forgotten that large sums had from time to time been credited to the company in the form of profit made on the sale of securities. Many questions had arisen between the company and the Western Union in connection with the lease, and in the autumn of last year the Secretary visited the stations and property in Newfoundland, Canada, and the United States and performed useful work in clearing up those matters. Within the last few weeks they had had the pleasure of meeting Mr. Newcomb Carlton, who had just been elected President of the Western Union Co., and he was glad to be able to state that their relations with that company were of the most friendly and amicable character, and, as far as they could foresee, they had every reason to anticipate that the Western Union Co. would continue to regard their arrangement with them as being as satisfactory to the Western Union as it was to themselves.

Mr. H. C. B. UNDERDOWN seconded the motion, and the report was adopted without discussion.

Brush Electrical Engineering Co., Ltd.

MR. E. GARCKE presided at the offices of the Electrical Federation, Kingsway, on Monday, over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (ELEC. REV., p. 666), said the operations of the company during the year resulted in a profit of well over £20,000 after providing for the maintenance of plant and buildings and after deducting all debenture interest. This result was due mainly to the extraordinary efforts exerted by their managing director and his able staff, and they were very grateful to him, and the shareholders were to be congratulated that after a long story of adverse fortune they had been able to produce a favourable report. The year had been a strenuous one, but they had had the satisfaction of knowing they had been on the up grade instead of the down grade, and with that incentive their efforts had been less harassing than for some years past. It was satisfactory also that the profit was not due in any way to windfalls, but had been earned in the ordinary manufacturing and trading business of the company. Happily they had been free from labour troubles in their works, although some of their neighbours had suffered from local strikes, the settlement of which they, as members of the local Engineering Employers' Association, had been able to shape. When he addressed them last year he explained that the scheme for the reduction of capital which was approved in 1912 by a committee representing the shareholders and other interests had been in abeyance, as there did not appear to be any useful purpose to be served in proceeding to give effect to the scheme until they were at least paying their way. They now proposed to proceed with the scheme and apply to the Court for the necessary sanction. The effect of that scheme, they would remember, was to reduce the preference shares to the nominal value of 7s. each and the ordinary shares to the nominal value of 5s. each, both classes of shares to rank alike and be converted into one common denomination. This would enable the amount standing to the debit of profit and loss account to be extinguished, and they would then be in a position to divide the profits which might be earned in the future. There was very little to be said on the account, and that little was satisfactory. The general charges showed a reduction from £19,470 in 1911 to about £17,000 last year—a reduction of about £2,500. In the balance sheet the only item to which he need call attention was the reduction in the amount owing to creditors which, he was glad to say, had been reduced by as much as £38,000, thus showing that not only had the company made profits, but it had strengthened its financial position. With regard to the work of the year generally, he might say that in all departments they had been fairly well occupied, and that the prices obtained for their productions had been better, although in many cases they were still too low having regard to the difficulties of the business and the inevitable large working expense. One of their principal lines of manufacture was that of turbo-generators, and the company had received its share of orders which had been placed for this class of plant during the past year. The markets for turbines continued to develop, and the demand was likely to increase in the future. It was in anticipation of this demand that they acquired the manufacturing rights of the Ljungstrom turbine, for which they expected a ready sale in stations where economy of steam consumption was of special importance. They had made good progress in their arrangements for the manufacture of the Ljungstrom turbine, but naturally the preparations for turning out a new design embodying many special features had taken time. However, he was able to report that the first set of their own manufacture had been completed and the test showed very satisfactory results. Other sets on order were well advanced, but to enable them to develop the business in this line to the best advantage to cope with the expected demand, they would have to spend some money for special tools and also for stocking certain parts, so that reasonably early deliveries could be guaranteed. They had one or two alternative methods for dealing with the situation under consideration, one of which would no doubt provide a satisfactory solution. On the rolling stock side of their business they had been pretty busy and had carried out important contracts for railway stock for the underground railways of London, the Great India and Peninsular Railway, and other railways. They had also turned out a large number of motor omnibus bodies for the principal London and provincial companies. This was a class of work for which their long experience as builders of tramcars and horse omnibuses and similar vehicles peculiarly fitted them, and was one in which they had already established a good reputation. A gratifying feature had been the revival in the demand for electric tramcars, of which they had had a fair share of orders during the past year. With regard to the current year he was glad to say the orders on their books were well up to the average; and although there were some indications of a falling off in trade generally, he was hopeful that in their business the demand would be maintained and that they would continue to make satisfactory progress.

Mr. B. S. BROADHURST seconded the motion and the report was adopted without discussion.

Cork Electric Tramways and Lighting Co., Ltd.

THE directors' report for the year 1913 states that the receipts were £60,135 and the expenses £37,524. After adding £1,261 brought forward and deducting interest on debentures £4,600, there remains a balance of £19,273. Of this amount £6,163 was paid for the dividends on the 5 per cent. cum. pref. shares, £6,500 was added to reserve for depreciation and renewals, £1,807 written off, and there is to be paid a 3 per cent. dividend on the ordinary shares, requiring £3,450, and leaving £1,352 to carry forward. The lighting and power business again shows satisfactory progress, agreements for 136 connections being concluded during the year. The additional connections represent a total gain of 212 KW. as against 225 KW. in 1912. The lighting and power receipts were £1,894 in excess of the previous year. The traffic receipts also show an increase of £716, this being due to the exceptionally fine summer of last year. There is a small decrease in the other revenue items. The expenses were £1,928 in excess of 1912, chiefly owing to the enhanced price of coal, heavier maintenance charges for permanent way, third party accident claims, and contributions under the National Insurance Act. The capital expenditure during the year amounting to £9,450 has been mainly for house services and cables and an additional 1,000 KW. generating set required to meet the increasing demand for lighting and power. One of the original 225 KW. generating sets has been dismantled and the cost of same, together with the cost of five permanent way loops which have been dispensed with, have been written off out of the reserve for depreciation and renewals.

	Traction.					Lighting and power.	
Year.	Miles open.	Passengers carried.	Average fare.	Car-mileage.	No. of cars.	No. of customers.	8-c.p. lamps. (equiv.) connected.
1911 ..	9·89	5,846,523	1·07d.	891,417	85	2,389	155,533
1912 ..	9·89	5,695,103	1·06d.	898,153	85	2,539	168,774
1913 ..	9·89	5,864,339	1·06d.	893,594	85	2,665	170,926

Anglo-Argentine Tramways Co., Ltd.

The directors, in their report, give the result of the working for the year 1913 as follows:—Gross receipts, £2,963,192, less working expenses (which include various items amounting in the aggregate to £150,000 carried to depreciation renewals reserve, in addition to £347,651 expended on ordinary maintenance), £1,969,161, leaving £994,031, plus interest on investments and deposits, £20,084, transfer fees, &c., £558, and £9,254 brought forward, making £1,023,926. Interest and charges amount to £791,130, and are made up as follows:—To annuity to City of Buenos Ayres Tramways Co. (1904), Ltd., £70,660; 4 per cent. debenture stock interest, £174,060; 4½ per cent. debenture stock interest, £77,480; 5 per cent. debenture stock interest, £215,303; interest in London on temporary loans and payments received in respect of share capital before allotment, £7,103 = £473,946, less interest on works in course of construction charged to capital, £98,863, leaving £375,083; sinking funds for redemption of debenture and share capital (4 per cent. debenture stock, £24,295; 4½ per cent. debenture stock, £3,645; share capital first and second preference and ordinary, £3,947), £31,887; first preference dividend, 5½ per cent., £176,000; second preference dividend, 5½ per cent., £137,500 = £791,130. The interim dividend on ordinary shares for half-year ended June 30th, 1913, absorbed £100,000, leaving £132,796. Out of this balance the directors now recommend that £119,375 be paid as a final dividend for the year ending December 31st, 1913, which with the £100,000 paid as interim dividend is equal to 6½ per cent. on the total issued ordinary share capital of £3,250,000, leaving £13,421 to be carried forward.

Subways.—The first subway line, Plaza Mayo to Plaza Once, where, at the terminus of the Buenos Ayres Western Railway, a joint underground station has been constructed, was opened to the public on December 2nd, 1913, a distance of 2 miles 820 yards. The work in connection with the construction of the extension of this line to Caballito, where it will come up to the surface, is being rapidly pushed forward, and it is hoped will be opened for traffic for the whole distance in August.

Arrangements have been made whereby 150,000 ordinary shares of £5 each have been taken up by the present owners of the ordinary share capital.

The directors have thought it desirable to charge the 12 per cent. municipal tax to the revenue of the year in which the traffics on which it is calculated are received, although the tax is payable only in the following year. As this change of method would on this occasion have the effect of debiting revenue with two years' tax, that of 1912 and 1913, the amount for 1912 has been charged to reserve, and the amount for 1913 to revenue, and the ordinary shareholders have provided the amount taken from reserve in order that the fund may not be reduced. The board have to announce the deaths of three of their colleagues, Mr. Victor Fris, president of the Société Financiare de Transports et d'Entreprises Industrielles, Brussels; Mr. T. Frame Thomson, the deputy-chairman; and Mr. E. A. Lazarus-Barlow, for 15 years a member of the board. These three vacancies have been filled by the election of Mr. Léon Cassel, Mr. W. F. Hamilton, K.C., and Mr. G. A. Touche, M.P.

The manager makes a full report on the work of the year, which was worse commercially than 1912.

Comparative Table.

Year.	Receipts.	Expenditure.	Passengers carried.	Miles run.	Receipts per mile run.	Expenses per mile run.	Cars in stock.
	£	£			d.	d.	
1911	2,681,836	1,723,928	299,154,885	46,019,828	13·73	8·36†	2,207
1912	2,778,302	1,824,021	316,260,057	47,765,667	13·96	8·49†	2,557
1913*	2,963,191	1,969,161	342,140,422	50,872,935	13·98	8·68†	2,555

* Includes one month's working of first section subway. † Does not include credits or debits to depreciation renewal funds.

Oldham, Ashton and Hyde Electric Tramway, Ltd.

The annual meeting was held on Friday last at Electrical Federation Offices, Kingsway.

Mr. E. Garcke presided, and moved the adoption of the report (see Electrical Review, page 668). This gave the following figures:—

	1912.	1913.
Route miles	9 m. 1 f.	9 m. 1 f.
Passengers carried	6,075,451	6,296,971
Average receipts per passenger	1·32d.	1·31d.
Average working expenditure per passenger	·84d.	·82d.
Proportion of expenses to receipts	63 %	63 %
Cars in stock	46	46

Mr. J. Vincent Kitchener seconded the motion, and the report was adopted.

Provincial Cinematograph Theatres, Ltd.—The directors' report for 1913 shows excellent progress enabling a final dividend of 7½ per cent. to be paid on the ordinary shares, making 20 per cent. for the year. It is stated that during the last three months the business has been greater than at any previous time in the company's existence.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended February 27th, 1914, amounted to 996,753, compared with 790,198 units in the corresponding four weeks of 1913. For the four weeks ended March 27th, 1914, the figures are:—1,125,083 units, compared with 890,782 in 1914.

Launceston and District Electric Supply Co., Ltd.

The annual meeting was held on April 7th, and the report (see Electrical Review, page 667) was adopted. Mr. R. B. Rogers, who presided, said that there should be a much larger balance available next year, when they would commence to build up a fund for depreciation. The capital invested in the concern was now £9,000. After the experience gained during the year 1913, with dearer coal and insurance and higher wages, they suggested that, as from midsummer, the lighting rate be raised from 5d. to 6d. per unit, the power rate remaining unaltered at 3d. With very few exceptions, 6d. was the usual rate charged in the West of England, in most of the smaller towns and some of the larger ones. The chairman spoke highly of the services of the engineer (Mr. Willey) and his staff. Mr. Willey's term of engagement came to an end next September, and they regretted that he had secured another appointment.

Mr. W. H. Symons, the vice-chairman, also referred to the proposed increase in price. He said that, on comparison, they found that every town in Devon of anything approaching the size of Launceston charged 6d. or 7d. per unit for their electric light, whilst in Cornwall there were more above than under. He found, too, that in several places in the suburbs of London, where they had populations of from 50,000 to 70,000, the price was 6d. per unit. He felt the time had come when they must, in justice to their shareholders and to others as well, work this as a commercial, and not a philanthropic undertaking, and they considered that with a judicious use of the electric light on the part of the consumers, the price would compare very favourably with the price of gas.

Oriental Telephone and Electric Co., Ltd.

The directors' report for the year ended December 31st last states that including £33,335 brought forward from December 31st, 1912, and after deducting the interim dividends, paid November 1st last, on the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and other charges, the amount to be dealt with is £65,213. The directors recommend a final dividend of 3 per cent. (less income-tax) for the year on the preference shares, requiring £1,500; a final dividend of 6 per cent. (free of income-tax) on the ordinary shares, making 10 per cent. for the year, requiring £10,759; transferring to reserve account £5,000; to staff pension fund £2,000; and carrying forward £45,954. The company's own exchanges all show increased revenues, and the number of new subscribers has reached a record during the past year; similar increases in both subscribers and revenue have also been recorded by all the subsidiary companies. The Bombay Telephone Co., Ltd., have increased their dividend from 10 to 12 per cent., and the Bengal Telephone Co., Ltd., their dividend from 6 to 7 per cent. The Telephone Co. of Egypt, Ltd., and the China and Japan Telephone and Electric Co., Ltd., have paid their previous rates of 10 and 5 per cent. respectively. To meet increasing business, considerable extension and reconstruction work is in progress at Singapore, the effect of which will, it is hoped, show an important improvement in the revenue at that branch during the current year. The new premises of the company in Port Louis, Mauritius, are approaching completion; subscribers continue to join the Central Exchange in good numbers, and a small sub-exchange has been opened at Rose Hill. The directors have purchased during the year £7,980 of Consols, bringing the holding up to £20,000.

Willans & Robinson, Ltd.—For the year ended December 31st, 1913, the directors report a net profit of £8,782, after payment of debenture interest, provision for depreciation of stocks, and the proper upkeep of Queen's Ferry Works. Warrants are being issued on 30th inst. in respect of the dividends on the "A" and "B" preference stocks, and also in respect of the interest on the outstanding funding certificates. A dividend at the rate of 10 per cent. per annum is recommended on the ordinary shares, leaving a balance of £1,679. In view of the large amount by which the Rugby plant and premises were depreciated during the year under review in connection with the share capital reduction, the directors consider no need exists for further provision in these accounts. The year's operations were adversely affected by a strike in the foundry, which, in itself, covered a period of some three months. Important contracts for both steam turbine installations and Diesel oil engines were concluded during the year, and the business in hand for these classes of machinery and in other lines is promising. The meeting will be held at Rugby on April 30th.

Ramsgate and District Electric Supply Co., Ltd.—The directors' report for 1913 shows that including £762 brought forward the gross profits amount to £4,454, and after allowing for interest at the rate of 5 per cent. per annum on outstanding accounts due to the contractors, there is a balance of £3,034. After declaring a dividend of 5 per cent., and placing £1,000 to the reserve account, £1,034 remained to be carried forward. During the year 3,916 ordinary shares were issued and fully paid up.

Telephone Co. of Egypt, Ltd.—The directors recommend a dividend of 6 per cent. (6s. per share), free of income-tax, on the preferred and deferred shares for the half-year to December 31st, making 10 per cent. for the year. £142,242 is to be carried forward.

Bromley Electric Light and Power Co., Ltd.—Mr. F. E. Gripper presided at the annual meeting held recently. He said that the company was making steady progress. The lamp connections had increased by nearly 8,000, which was 7 per cent. Sale of current increased by £450 or 3 per cent. Costs advanced by £366. They had reduced the price of current for heating and cooking to 1½d. per unit, and a demonstration given two or three months ago had produced very satisfactory results. Their shares in the Chislehurst Co. only paid them 3 per cent. this year as compared with 4½ per cent. last year, this being caused by lessened consumption in large houses which now used the metal-filament lamp. They were able to recommend 7 per cent. dividend, an increase on the figure which they had paid for many years, namely, 6 per cent. They had set aside to general reserve £4,000, making that fund £42,000, or over 30 per cent. of the entire capital.

City Electric Light Co. (Brisbane), Ltd.—In their report for the year ended January 31st, 1914, the directors state that after making additions to the franchise and purchase sinking fund, accident insurance fund, and renewals, replacements and contingencies account, and also writing off £3,000 from the Ann Street station, there remains a credit balance £18,994, plus the balance brought forward making £20,447. An interim dividend was paid in September amounting to £9,342, and further dividends were payable on March 18th of 3 per cent. on the preference shares and 6½ per cent. on the fully paid ordinary shares, and 6½ per cent. on the contributing shares. The balance remaining to be carried forward is £1,268. Although the capital expenditure has increased during the year by about £30,000 for additional plant, no return has been yet received from it. As this plant is almost completed the directors expect to receive the full benefit in the near future.

Bell Telephone Co. of Canada.—The gross earnings for 1913 amounted to 8,850,400 dols., an increase of 1,212,100 dols. After deducting expenses and writing off 1,680,000 dols. against depreciation there remains a net revenue balance of 2,215,300 dols., an improvement of 335,100 dols. The dividends, amounting to 8 per cent. require 1,289,800 dols., leaving a surplus of 503,700 dols.; 49,100 dols. has been transferred to reserve, and 454,600 dols. added to surplus brought forward from 1912, gives a total of 907,800 dols. to be transferred to the 1914 account. 30,918 subscribers have been added during the year, the total number of telephones now in use being 223,666. 7,977 miles of wire were added to the long-distance system in 1913.

Isle of Wight Electric Light and Power Co., Ltd.—The annual meeting was held recently at Ryde. Mr. F. E. Gripper presiding. The chairman said that 8,000 33-watt lamps had been added, and the receipts from sale of energy had advanced by £452, which was less than they might have expected from the increase in lamp connections—the metal-filament lamp was the cause. The coal bill alone was £478 more than for the previous year, and the result was £179 less profit. After paying debenture interest, &c., they had £1,128 more than last year to deal with, and recommended a dividend of 2½ per cent., as against 2 per cent. a year ago. A steady improvement in the business was in prospect.

Birkdale District Electric Supply Co., Ltd.—The directors' report for 1913 states that the capital expenditure account has been increased by £3,209 to £45,049. The revenue was £6,475, an increase of £154. The directors recommend a dividend of 9 per cent. on the ordinary shares, carrying forward £315. A new 350-KW. steam-driven set has been installed, and a new boiler is on order.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital stock.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange seems destined to misfortune, and one thing after another dogs the footsteps of business to such an extent that confidence is waylaid, hope frustrated, and cheerfulness well-nigh pulverised.

On this evening of writing it is Mexico which is playing the part of bad fairy to the markets at large, the Stock Exchange straining its ear to catch the first sound of fighting between that country and the United States. The life of the Austrian Emperor, too, is declared to be hanging in the balance; and though he is an old, old man, the actual event itself would probably disturb European politics to a mild extent. These are two of the principal considerations weighing down markets, prices and bullishness. Fortunately, they have only slightly affected the departments with which these notes deal in particular, Mexican issues excepted. Most Mexican securities are flat.

To hands more clever and technical must be left the analysis of the report presented to the London County Council by Messrs. Merz and McLellan on the subject of London's electricity supply. It is only with the influence upon the Stock Exchange market that this column is concerned, and this can be stated as favourable. There is diversity of opinion as to whether, after all, the existing state of affairs were not better left undisturbed, but the principal consensus of opinion certainly appears to lie with those who claim that London ought to be supplied with its electric power through the agency of one central undertaking or body, which ought to be some other than the London County Council. That something will be done is accepted as manifest, and this is hailed as a bull point for the market, since any arrangement at all is expected to advantage the companies. Prices of the shares, therefore, keep firm, City and County Ordinary showing small losses. The depression in markets all round, passes over electric lighting quotations, and once again the sellers are in the position, in many cases, of being able to obtain something better than the middle prices if they wish to realise.

The Home Railway market has been glum. Prices having gone done on the trouble which broke out on the South Yorkshire coalfields, not only failed to recover when that difficulty was settled, but receded still further, the depression in Consols being the principal contributory factor. Metropolitans and Districts weakened, and Underground Electric issues lost a little of their previous sharp rises. The Income Debentures are 1½ down.

Rumours, as curious as they are vague, are in quiet circulation to account for the recent pronounced strength in the shares of the Underground Electric Railways Company. The London General Omnibus Company, it is patent to all Londoners, is doing a magnificent business, but the traffic receipts, good as they are, scarcely appear to be so remarkable as might be expected. It would be possible, of course, for the company to work some of the most paying routes by means of the 'buses of concerns allied to it, thereby in some degree disguising the full measure of its own prosperity; though probably this theory would not have been put forward at all had it not been for the fact that the 'bus company's receipts do not seem as imposing as might have been supposed. Apparently there is a strong party accumulating the £10 shares; and while the offering of advice as to such speculative things as these shares lies outside the province prescribed here, it may perhaps be no offence to suggest that holders of these shares should by all means keep them, since in days to come they may do better out of them than they can at present. By the same token, London and Suburban should benefit indirectly; in fact, the whole of the group might be expected to share to a larger or smaller extent in the abounding prosperity of one of its members. The Central London Assented stocks have each gained a point. London United Tramways Debenture stock, however, weakened to 60, and Metropolitan Electric Trams First Debenture stock is a little easier.

Brazilian and Canadian conditions remain none too happy, and they are reflected in falls in such things as Shawinigan Water, Canadian Generals, Montreal Light and Power, Rio Tramway bonds, and so on. Montreal shares stand at a figure at which it requires little demand or supply to move the price five points at a time. This week it is Supply that has been the more prominent. Adelaide Supply Preference shares are better, rising ¼ to 5½. No change has occurred in the nominal quotation of Vera Cruz Debenture stock, although, of course, it is doubtful whether any reasonable amount could be sold at the existing quotation. Anglo-Argentine Tramway Debenture stocks are good on a report showing further remarkable progress.

The Telephone group is quietly firm, with small rises in Eastern Ordinary, Eastern Extension shares and Anglo-American Telegraph Preferred. Marconi's, however, developed fresh flatness, following upon the fall brought about by the unsatisfactory results achieved by the American Company. Stale bulls have been getting out, but observers notice that, even so, the market seems to be none too well supplied with shares. West India and Panama fell ⅛, which raises the return on the money to 5½ per cent. Globes are a little easier. The Indo-European Company has declared its regular dividend, making 13 per cent. for the year; this rate has been maintained since 1904, and the distributions are made free of income-tax. The shares rose 10s. Oriental Telephones are unaltered on the dividend declaration, making 10 per cent. for the year. Some people looked for more.

Brush Debentures are still one of the principal features of strength in the manufacturing group. The Firsts have risen 4 points, the Seconds 2—the demand is due, of course, to the progressive report, upon which comment was made last week. At the meeting, the chairman spoke hopefully of a new turbine. The disappointment felt with the Babcock & Wilcox dividend of 16 per cent., instead of the 20 per cent. which optimists had hoped for, is now subsiding, and the price has recovered about 2s. a share. The company occupies a splendid financial position, and the board earns commendation from the most austere critic by virtue of its policy of fortifying reserve funds and the like.

Small falls occurred in British Aluminium Preference and Dick, Kerr Preference. General Electric Debenture stock hardened to 87 on the heavy over-subscription for the Company's new issue of shares; the Ordinary have risen to 22s. 6d. premium, the Preference are about 2s. 6d. premium. An issue of Hendon Electric shares was placed, semi-privately, with no difficulty at all, and the price has been steadily creeping up. The new South London Preference can be sold about 6s. premium, or more, and other new issues in this market are holding their premiums robustly enough. The rise in the price of raw rubber to 3s. a pound attracted a little academic attention, but the Stock Exchange market was none too certain of the reason for this advance, and prices in the share market have moved only languidly. In the Armament section, the allotments of the new Vickers shares are now out, and the price for the letters of allotment is 5s. for cash.

The heaviest fall in Mexicans has occurred in the Light and Power issues, the Common shedding 2, the Preferred 5½, and the bonds 3 and 2 points for firsts and seconds respectively. Mexico Trams dropped 4, Monterey's 2, and so on. With the crisis more acute than ever, prices in the very nature of things have become almost nominal.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — ½	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	15½ — 17½	..	..
Do. Do. Deferred	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb.	100	5	5	93 — 95	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 82	..	5 9 9
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	+1	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	+1	4 14 3
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	+1	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	+2	5 2 7
Lancashire United, 5 % Deb.	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord.	1	..	..	⅛ — ¼	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	6 19 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	78 — 83	..	5 8 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	–1	6 9 0
Metropolitan Railway Consol.	100	1⅜	1⅜	41½ — 43½	–1	3 17 0
Do. Surplus Lands	..	2½	2½	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord.	100	Nil	..	28½ — 29	–½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	88 — 91	–1	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 18 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	⅞ — 1	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	½ — ⅝	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	8⅞ — 8¼	— ⅛	Nil
Do. "A"	1/-	..	..	⅛ — ¼	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	114 — 116	+ 2	5 3 5
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	..	4 8 8
Do. 6 % Income	100	6	6	90 — 91	— ½	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	4	4⅛ — 4½	+ ⅛	4 4 3
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 3

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅜ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4⅛ — 4⅜	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98 —101	+1	4 9 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	..	7 1 2
Brisbane Trams Invt., Ord.	5	8	8	7⅛ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	117 —121	..	6 12 4
Do. Pref. Ord.	100	6	6	105 —109	..	5 10 1
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	96 —99 xd	..	4 11 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9†	7 — 7½	..	6 6 8
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	+1	4 10 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 8 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅛ — ⅜	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1⅜ — 1⅝	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	+4	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 83	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	67 — 70	— 4	..
Do. Gen. Con. 5 % Bonds	..	5	5	75 — 79	— 4	6 6 6
Do. 6 % Bonds	100	6	6	78 — 83	..	7 4 7
Para Elec. Rlys. & Lt., Ord.	5	10	10	8⅜ — 8¾	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	..	5 8 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91½	— ½	5 9 3
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4¼ — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½ — 10⅝	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8½	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91⅛ — 94⅛	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅛	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	+⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅞ — 4½	+⅛	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	9	10	16½ — 17½	— ½	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12⅝ — 13⅝	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	11⅝ — 12½	— ½	5 14 3
Do. 6 % Pref.	10	6	6	11⅝ — 12⅝	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	+ ½	4 5 3
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 4⅝	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8¾ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7¾ — 8	..	5 13
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1⅝	..	5 2 7
Do. 6 % Pref.	5	6	6	4½ — 5⅛	..	5 17 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	8⅜ — 8⅞	..	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101 xd	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7	7	5⅛ — 6⅛	..	5 11
St. James' and Pall Mall, Ord.	5	10	12	9½ — 9¾	..	6 3 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2⅞ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	94½ — 97½	..	4 12 4
Urban, Ord.	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum Pref.	5	3†	4	2½ — 3 xd	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 12 3
Westminster, Ord.	5	10	10	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 3/16	..	4 4 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	+ ⅛	£ 5 11 7
Calcutta, Ord.	£	8¼	6†	7⅞ — 8	..	£ 5 6 3
Do. 5 % Pref.	£	5	5	5 — 5⅛	..	£ 4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	£ 5 8 0
Canadian Gen. El. Com.	$100	7	8	109 —113	—2	£ 7 1 7
Do. 7 % Pref.	$100	7	7	118 —123	—1	£ 5 18 10
Cordoba Lt., Power and T., Ord.	£	5	..	⅞ — 1	..	£ 7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	£ 5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	£ 6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	£ 5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	98½ — 95½	..	£ 5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅞ — ⅝	..	Nil
Do. 6 % Pref.	£	6	6†	4⅝ — 4¾	..	£ 10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	£ 4 16 2
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½ —106½	..	£ 4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	63 — 68	—2	£ 7 7 1
Mexican Lt. & Power, Common	$100	4	4†	36 — 41	—2	..
Do. 7 % Cum. Pref.	$100	7	7	70 — 74	—5½	£ 9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	75 — 80	—3	£ 6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	63 — 67	—2	£ 7 9 3
Monterey Ry., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	£2 — £7	—2	£ s. d. ..
Montreal, Lt., H. and Power	$100	9	10†	223 —228	—5	£ 4 7 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	..	£ 3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	£ 5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	£ 4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	£ 4 8 3
Shawinigan Water, Capital	$100	5½	6	133 —137	—3	£ 4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	£ 4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ —103½	+ ½	£ 4 7 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95½ — 97½	+ ½	£ 4 12 4
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	£ 5 12 4
Victoria Falls Power, Pref.	£	6	6	3⅝ — 3¾	..	£ 7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	..	£ 5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	7	..	3⅜ — 3⅞	..	£ 5 0
Do. 6 % Pref.	£	6	6	⅞ — 1	..	£ 6 17 2
Babcock & Wilcox	£	16	16	8½ — 8¾	+⅛	£ 5 1 5
Do. Pref.	£	6	6	1⅝ — 1⅞	..	£ 4 8 6
British Aluminium, Ord.	£	..	5	1⅝ — 1⅞ xd	..	£ 11 4
Do. 6 % Cum. Pref.	£	6	6	1⅝ — 1⅞ xd	—⅛	£ 6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	98 — 99	..	£ 5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	£ 5 7 6
B.I. & Helsby Cables	£	10	13	9⅛ — 9⅜	..	£ 6 18 4
Do. Pref.	£	6	6	5⅝ — 6⅛	..	£ 4 14 1
Do. Deb.	100	4½	4½	101 —104	..	£ 4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	£ 4 15 9
British Westinghouse, Pref.	£	2	Nil	1⅜ — 1½	..	£ 6 13 4
Do. Deb.	100	4	4	73 — 75	..	£ 5 6 8
Do. 6 % Prior Lien	100	6	6	100 —108	..	£ 5 16 6
Browett, Lindley, Ord.	£	1	..	2/- —3/-	..	Nil
Do. Pref.	£	1	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	2	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	£ 5 17 8
Do. 4½ % Deb.	100	4½	4½	46 — 50	+4	£ 9 0 0
Do. 4½ % Second Deb.	100	4½	4½	28 — 32	+2	£ 14 1 4
Callender's Cable	£	15	5†	11⅜ — 12½	..	£ 6 0 0
Do. Pref.	£	5	5	5 — 5⅛	..	£ 4 16 5
Do. Deb.	100	4½	4½	97 —100	..	£ 4 10 0
Castner-Kellner	£	20	22½	23 — 25	..	..
Do. Deb.	100	4½	4½	104 —107	..	£ 4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	£ 5 17 8
Dick, Kerr	£	1	Nil	⅜ — ⅝	..	..
Do. Pref.	£	1	6	6⅜ — 6⅝	—⅛	£ 7 13 4
Edison & Swan, A, £2 paid	£	5	Nil	0 — ⅛	..	Nil
Do. fully paid	£	5	Nil	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	£ 6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67	..	£ 7 9 1
Electric Construction	£	1	5	1¼ — 1⅜	..	£ 7 12 6
Do. Pref.	£	1	7	1⅝ — 1⅞	..	£ 6 11 7
Greenwood & Batley, Pref.	£	10	7	6¾ — 7¼	..	£ 9 13 2
Do. Deb.	100	5	5	92 — 94	..	£ 5 6 5
General Electric, 6 % Pref.	£	10	6	10½ — 10¾	..	£ 5 14 3
Do. Deb.	100	4	4	85 — 89	+1	£ 4 10 0
Henley's, Ord.	£	15	20	13½ — 14½	..	£ 6 17 11
Do. Pref.	£	4½	4½	4⅛ — 5⅛	..	£ 4 9 0
Do. Deb.	100	4½	4½	101 —103	..	£ 4 7 5
India-Rubber, G. & T.	£	10	7½	10½ — 11½	..	£ 6 10 5
Do. Pref.	£	10	5	8½ — 9½	..	£ 5 5 8
Telegraph Construction	£	12	20	36 — 38	..	£ 6 6 7
Do. Deb.	100	4	4	98 —100	..	£ 4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	..	£ 5 17 8
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	10	4½	5⅜ — 6⅛	..	£ 7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	£ 5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	£ 6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	+1	£ 4 4 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	£ 4 9 7
Do. 6 % Pref.	Do.	6	6	109½ —110½	+ ½	£ 5 8 7
Do. Def.	Do.	30/-	30/-	23⅜ — 24½	..	£ 6 8 9
Anglo-Portuguese Tel., 5 % Mort. Deb.	£	100	5	5	102 —104	..	£ 4 16 2
Chili Telephone	£	5	8	..	7⅜ — 7⅝	..	£ 5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	— ½	£ 4 17 7
Cuba Telegraph	£	10	6	6†	8⅜ — 9⅜	..	£ 6 8 1
Do. 10 % Pref.	£	10	10	15½ — 16½	..	£ 6 19 5
Direct Spanish Telegraph, Ord.	£	5	4	4	3½ — 4	..	£ 5 0 0
Do. 10 % Cum. Pref.	£	5	10	10	7⅜ — 8	..	£ 6 5 0
Direct United States Cable	£	10	4	4	6⅜ — 7⅜	..	£ 5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	£	100	4½	4½	97 — 99	..	£ 4 10 10
Eastern Telegraph, Ord. Stock	£	Stock	7	7	183 —186	+1	£ 5 3 0
Do. 3½ % Pref. Stock	£	Do.	3½	3½	77½ — 79½	..	£ 4 8 1
Do. 4 % Mort. Deb.	£	Do.	4	4	96 — 98	..	£ 4 1 8
Eastern Extension	£	10	7	7	12½ — 13	+ ⅛	£ 5 7 9
Do. 4 % Deb.	£	Stock	4	4	94½ — 96½	..	£ 4 3 0
Globe Telegraph and Trust	£	10	6	6†	11 — 11½	— ⅛	£ 5 4 4
Do. 6 % Pref.	£	10	6	6	12½ — 13	..	£ 4 12 4
Great Northern Telegraph	£	10	20	20	82 — 84	..	£ 5 17 8
Indo-European Telegraph	£	25	13	13	59½ — 60½	+ ½	£ 5 7 4
Mackay Companies Common	$	100	5	5	85 — 88	..	£ 5 13 8
Do. 4 % Cum. Pref.	$	100	4	4	70 — 73	..	£ 5 9 7
Marconi's Wireless Telegraph	£	1	20	20	3⅛ — 3⅜	—⅛	£ 5 18 4
Do. 7 % Cum. Partic. Pref.	£	1	17	..	2⅝ — 2⅞	—⅛	£ 5 18 3
Monte Video Telephone, Ord.	£	1	6	6	1⅜ — 1⅝	..	£ 6 8 0
Do. 5 % Pref.	£	1	5	5	⅝ — ¾	..	£ 5 14 3
New York Telep., 4½ % Gen. Bnds.	£	100	4½	4½	100 —101	..	£ 4 9 0
Oriental Telep. and Elec.	£	1	10	10	2⅜ — 2⅝	..	£ 4 4 3
Do. 6 % Cum. Pref.	£	1	6	6	1⅜ — 1⅝	..	£ 4 11 5
Do. 4 % Red. Deb.	£	Stock	4	4	87½ — 89½	..	£ 4 9 5
Pacific and European Tel., 4 % Guar. Debs.	£	Do.	4	4	98 — 100	..	£ 4 0 0
Reuter's	£	10	10	10†	8 — 9	..	£ 11 2 2
Submarine Cables Trust	£	Cert.	6	6	125 —128 xd	+1	£ 4 13 9
Telephone Co. of Egypt, 4½ % Deb. Red.	£	Stock	4½	4½	98 — 100	..	£ 4 10 0
United River Plate Telephone	£	5	8	6†	6⅜ — 6⅞	..	£ 5 16 5
Do. 5 % Cum. Pref.	£	5	5	5	5⅛ — 5⅜	..	£ 4 9 0
West Coast of America	£	2½	2½	..	1⅝ — 1⅞	..	£ 4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	£	100	4	4	96 — 99	..	£ 4 0 10
West India and Panama Teleg.	£	10	1½	1½	2⅜ — 2⅞	—⅛	£ 5 2 7
Do. 6 % Cum. 1st Pref.	£	10	6	6	9⅜ — 10⅜	..	£ 5 18 5
Do. 6 % Cum. 2nd Pref	£	10	6	6	8¼ — 9⅜	— ⅛	£ 6 8 0
Do. 5 % Debs.	£	100	5	5	96 — 99	..	£ 5 1 0
Western Telegraph, Ltd.	£	10	7	7	13⅜ — 13⅞	+ ⅛	£ 5 1 11
Do. 4 % Debs.	£	Stock	4	4	96½ — 97½	..	£ 4 2 1
Western Union 4½ % Fdg. Bonds	$	1000	4½	4½	95 — 98 xd	+1	£ 4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

New Vapour Lamps.—According to the *Times*, a vapour lamp, prepared with fairly pure helium, will, under certain conditions, give a white light much resembling daylight, and the character of the illumination can be controlled when used on alternating-current circuits so as to become bright yellow or even violet. These remarkable results would, it is claimed, enable varying colour effects to be produced for stage illumination by merely controlling the electric current exciting the tubes. Another new vapour lamp has been produced by Herr Greinacher, in which a spark discharge takes place between platinum electrodes; a lamp of 90 C.P. has been constructed by him, running at 500 volts. By using potassium electrodes and making the discharge take place in helium gas, it is thought that these lamps may be run on the low voltages ordinarily used for lighting.

Electrically-treated Milk.—Four reports from experts on the electrical treatment of milk have been received by the Liverpool Health Committee, and they show that the keeping properties of the electrically-treated milk are increased; there is a great reduction in the total number of bacteria of all kinds; and the bacillus coli and its allies are absent. Consequently the reports confirmed the results of the observations by the local health department. The Liverpool bacteriologist (Dr. J. M. Beattie) stated that a very considerable advance had been made in rendering milk free from disease-producing bacteria without at the same time impairing the chemical constitution of the milk, but absolute sterilisation had not been generally accomplished. He was convinced that the bacteria which remained, both from their number and from their nature, were not harmful.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1914.

The returns of electrical business during March show increased totals both in the export and import sections; in the case of the former the value increased from £439,241 in February to £498,145 in the month in question, while the imports reached a total of £292,559, as compared with £270,032 in the previous month. The re-exports, on the other hand, with a total of £24,810, showed a decrease of nearly £500.

Excluding telegraphic exports, the general export business reached a total well above last year's monthly average, and this applies also to the imports as a whole, for which last year's month'y average was £245,000.

Of the individual items in the exports, machinery accounted for some £240,000; cable exports reached a satisfactory figure, but there was a falling off in the telephonic and lamp sections. In the imports the machinery, telegraphic and telephonic, and lamp sections show higher values as compared with the previous month. Our best customer during the month was India, with a total purchase of £77,000, which was slightly more than in the previous month; business with Argentina, Japan, and our Australian colonies also reached satisfactory dimensions. German imports were on a greater scale than in February, otherwise the import values show no particular change.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables (rubber and other insulations).	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,515	125	142	69	2,344	496	7,611	201	381	140	275	5,391	18,690
Germany	1,050	1,579	24	40	466	...	2,440	30	182	107	54	98	6,070
Netherlands, Java and Dutch Indies ...	944	1,055	318	...	42	126	916	...	119	91	96	2,626	6,333
Belgium	1,393	309	101	...	39	83	2,175	...	150	...	1,512	67	5,829
France	968	67	3,210	97	12	...	9,366	118	...	289	133	3,708	17,968
Portugal	127	20	...	10	...	...	1,166	359	19	9	56	2,115	3,881
Spain, Canary Isles and Spanish N. Africa...	604	76	14	68	...	95	11,617	...	58	239	389	323	13,483
Switzerland, Italy and Austria-Hungary ...	938	56	136	...	14	...	2,963	24	34	681	75	509	5,430
Greece, Roumania and Turkey	335	14	151	33	...	...	1,141	...	40	...	41	190	1,945
Channel Isles, Gibraltar, Malta and Cyprus...	78	...	78	52	...	19	206	...	2	...	8	4,583	5,026
U.S.A., Philippines and Cuba	535	2,944	...	100	61	405	1,174	...	...	...	...	1,235	6,454
Canada and Newfoundland	1,129	1,915	774	807	...	1,147	9,198	208	568	64	2,931	1,911	20,652
British West Indies and British Guiana ...	108	...	8	156	36	...	171	...	59	...	195	32	765
Mexico and Central America	10	...	85	32	10	...	1,193	526	11	...	...	17	1,884
Peru and Uruguay	232	...	...	14	...	...	57	312	...	...	585	...	1,200
Chile	505	35	43	...	...	156	1,488	...	606	43	134	396	3,406
Brazil	1,722	1,686	415	48	...	71	10,642	8,347	10	...	2,341	266	25,548
Argentina	4 344	14,594	392	1,899	432	883	19,413	1,763	332	24	3,283	5,019	52,378
Colombia, Venezuela, Ecuador and Bolivia...	380	...	20	...	41	...	1,270	...	16	14	273	191	2,205
Egypt, Tunis and Morocco	63	45	531	74	28	6	3,570	25	83	...	101	770	5,296
British West Africa	138	98	...	33	...	63	563	...	2	...	245	237	1,379
Rhodesia, O.R.C. and Transvaal	1,562	179	132	1,101	31	65	2,308	...	96	...	7	77	5,558
Cape of Good Hope	1,737	3,016	722	492	10	5,780	88	862	196	10	596	1,022	14,531
Natal	1,046	3,959	145	480	33	21	1,071	...	50	38	219	739	7,801
Zanzibar, Brit. E. Africa, Mauritius & Aden	696	172	192	34	...	33	529	99	163	10	41	317	2,286
Azores, Madeira and Portuguese Africa ...	105	623	91	90	...	212	2,008	...	18	...	...	161	3,308
French African Colonies and Madagascar...	58	...	...	...	...	...	170	...	...	...	...	...	228
China and Siam	1,441	10,817	651	298	...	256	2,150	511	536	...	...	13	16,673
Japan and Korea	5,019	56	449	...	10	773	32,424	4,433	19	2	382	...	43,567
India	6,417	9,263	3,830	1,948	49	707	38,653	4,094	5,131	410	1,120	5,555	77,177
Ceylon	323	381	290	23	14	61	74	...	94	...	142	78	1,480
Straits Settlements, Fed. Malay States and Sarawak	346	709	326	75	219	25	7,439	539	208	57	333	1,214	11,490
Hong Kong	605	803	268	38	...	247	1,377	26	93	10	24	257	3,748
West Australia	344	853	109	252	...	352	386	410	238	...	...	...	2,944
South Australia	432	800	297	...	...	743	3,245	...	1	...	675	436	6,629
Victoria	1,460	7,978	624	666	881	1,271	12,040	625	603	...	1,935	894	28,977
New South Wales	1,958	5,387	821	1,096	307	1,641	13,822	1,930	739	64	8,844	2,985	39,594
Queensland	223	1,974	15	208	...	325	1,976	270	219	...	822	135	6,167
Tasmania	...	115	14	...	...	...	18	...	...	35	32	...	214
New Zealand and Fiji Islands	1,355	1,082	561	615	69	832	6,062	150	1,013	48	7,222	942	19,951
Total, £	42,245	72,785	15,979	10,948	5,148	16,894	214,180	25,862	12,089	2,385	35,121	44,509	498,145

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	878	...	...	133	...	...	4,438	125	708	...	9,739	16,021
Germany	8,216	25,605	1,682	14,425	7,032	3,249	91,358	2,866	2,678	11,457	12,953	181,521
Holland	...	388	...	3,118	580	...	300	15	...	74	...	4,475
Belgium	902	5,138	39	262	15	17	7,074	...	624	490	6,467	21,028
France	530	...	453	2,359	131	1,955	1,042	...	1,620	3,707	525	12,322
Switzerland	377	1,895	...	11	...	1,436	3,945	...	...	214	14	7,892
Italy	...	5,425	...	...	45	...	34	...	...	...	34	5,538
Austria-Hungary	...	1,242	28	252	26	...	118	...	95	...	...	1,761
United States	10,825	158	409	...	413	82	11,998	13,513	1,097	53	2,249	40,797
Total, £	21,728	39,851	2,611	20,560	8,242	6,739	120,307	16,519	6,822	15,995	31,981	291,355

Additional imports: Spain, wires and cables, £55; carbons, £733; Japan, wireless apparatus, £200; Victoria, electrical fittings, £50; Canada, electrical goods, £166.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	14,040	703	...	3,112	468	...	4,658	...	531	882	416	24,810

TOTAL EXPORTS: £498,145 TOTAL RE-EXPORTS: £24,810 TOTAL IMPORTS: £292,559

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE PASSENGER TRANSPORTATION PROBLEM.

Report to the Special Sub-Committee of the Manchester Tramways Department, by J. M. McELROY, *General Manager.*

Like other large cities, Manchester finds itself faced with the problem of moving an increasing proportion of its population between their homes, their business, and their pleasure; is finding difficulty in meeting present requirements; and sees the necessity of providing betimes means to cope with those of the future. A special sub-committee of the Tramways Committee, appointed to study the position in November, 1911, presented an interim report in January, 1913, showing the magnitude and importance of the problem, and recommending that Mr. McElroy and Mr. Mattinson, general manager and permanent way engineer respectively of the Manchester Tramways, should make a journey of investigation at home and abroad, and report fully thereon for the further guidance of the sub-committee.

This they have done, and the book containing Mr. McElroy's account of the investigation, and recommendations that certain things shall be done, and other things considered and prepared for, in Manchester, as lessons derived therefrom and applied to the special conditions of Manchester, is now before us.

The book can be treated as divided into three main parts: the first descriptive of what has been done, and is being done, in fourteen large cities; the second (Parts II. and III.) lessons drawn from the investigation, and their applications to Manchester; the third (Parts IV., V. and VI.), definite proposals for street and tramway improvements in Manchester, with a discussion of the financial questions involved, the scope of the improvements as regards provision for the future, and suggestions as to further provision when rapid transit will have to be added to tramway and other street facilities.

The descriptive part of the book covers the passenger transport systems in existence, and in course of development, in New York, Philadelphia, Boston, Chicago, Pittsburg, Paris, Berlin, Vienna, Hamburg, London, and Glasgow, and is illustrated by city and district maps, plans of terminals, drawings and photographs of subways, elevated railways, stations, and vehicles, as well as by tables of statistics, giving, in 82 pages, 42 maps and diagrams, a concentrated statement of "the resources of civilisation" already applied to the transport of passengers in large cities, and the trend of development in the different places, as well as some statistical indications of the capacity, cost, and earning power of each. Highly valuable as this is, recorded by men who know what to look for, and how to state what they saw in concise and clear language, perhaps the most valuable information for general use is that describing the various forms of traffic organisation and control in the different foreign communities visited.

Criticism of this descriptive work is hardly called for; so far as it is possible to check it, accuracy is a distinctive note, and it is of later date than most of the records with which it could be compared. There is a little historical hiatus on page 63, where the wording suggests that the Metropolitan and Metropolitan District lines in London were originally constructed as the "Inner Circle," which it would be well to correct in any subsequent use of the Report for the sake of accuracy—it is not pertinent to the argument.

The illustrations of tramway and rapid transit railway terminal loops and stations in New York, Boston, and Paris, are lessons in the tackling of terminal problems well worthy of study by British tramway and railway engineers, who have not, as a body, realised the value of, or at least have not often put into practice, terminal arrangements of the loop or roundabout character, avoiding reversals and shunting of cars. Mr. McElroy, it will be seen, has learnt this lesson—as well as others. A notable and highly efficient example of this type of terminal (not mentioned in the Report) is that at the New York end of the Brooklyn Bridge, where the up and down tracks on the bridge are joined by a set of loops with ample standing space between them, so that cars, loading and unloading in "parallel," can arrive and be got away in a continuous stream on the bridge lines. The Victoria Embankment line of the L.C.C. tramways is a kind of terminal loop, but it lacks the parallel loading features essential to highest efficiency.

The principal lessons drawn from the investigation are summarised under six heads of very general application, of which the following is the most important:—

"(3). It is essential that every city should have a permanent authority directing the *initiation* and carrying-out of all schemes for new transit facilities in order that there may be continuity of policy, and that future needs of the city and the surrounding districts over a wide area are properly looked after. It is also desirable that all the means of passenger transportation—both surface and rapid transit—should be centralised under one management. If the management is not that of the city itself, then it should be subject to control and regulation by a permanent authority appointed by the city."

A Royal Commission on London Traffic said something very much like this nine or ten years ago, and it is still true, even for London.

There is a tacit assumption underlying the paragraph quoted, and indeed the whole of the applications of the Report, that an efficient solution of the passenger transportation problem in great cities is a vital public interest, a branch of that "good order and government" which all civic administration is intended to ensure and encourage. In describing the attitude of the New York city authorities to the provision of transit facilities (p. 13) we are told, in reference to the new rapid transit lines which are estimated to cost about £68,000,000, of which the city and the operating companies will find about equal shares: "the possibility of any ultimate profits to the city is remote. But the city authorities are not looking for profits. They are determined to provide adequate travelling facilities—and so important a duty on the part of the municipality do they consider this, that they have made up their minds to do it properly, even if it entails a charge upon the rates of the city." It is difficult not to suspect the author of some sympathy with this attitude, but it would be strong meat to put to a British municipality, much more to a Parliamentary Committee, and in his concrete recommendations the author discusses the financial results of his proposals upon the basis of what is usually called "sound finance." No other basis can be used here with any hope of success, and yet one thinks that it should be possible by this time to make an estimate of the social, industrial, and commercial value of good transport facilities in a great city, not altogether incommensurable with some expenditures from public sources. A study of transport achievements from this point of view is wanted, and has not yet been attempted, it is one of the few aspects of the subject on which the author maintains silence, advisedly, no doubt, for his immediate purpose; it is perhaps a part of the tacit assumption underlying the report, which he knows it is superfluous to express to the Manchester City Councillors. Doubtless he thinks that they will agree with the Bostonians, who (p. 35) "state that the time-saving effected by the rapid transit lines if reduced to a cash basis would represent a considerable amount of money."

The growth of the "Riding Habit" is a statisti-

cal subject of much importance and interest which the author discusses by the assembly of a considerable mass of statistics on pp. 88-97. From a sufficient amount of statistics some generalisations can be drawn, such as, *e.g.*, the proposition that the number of journeys per head of population tends to increase as the square of the population. This conclusion is quoted (but not accepted) by Mr. McElroy as having been derived from statistics of certain German cities, and the curves of number of journeys per head, and of population increases, given for some cities, correspond fairly with the statement. This is the case with Greater New York and Boston, but in Manchester and District, and Greater London, the number of journeys per head has increased much more rapidly than the square of the population, and other places could certainly be found showing a lower rate. Obviously, no useful conclusion can be drawn which does not take into account the periods at which additional travelling facilities were given, and no experience from any place, or group of places, can be applied to another place without very careful consideration of the local conditions, selection of similar places, and weighting of the resemblances and differences.

Mr. McElroy has an easier task; the growth of population, of traffic, and of the riding habit, in Manchester, in relation to the development of the tramway system, are at his fingers' ends, and to project the curve forward for 20 years demands an extrapolation in which there should be little risk of serious error. He has in diagram No. 43 plotted his estimate of future tramway "passengers carried" on the Manchester and Salford tramways, as a straight line through the years 1904 and 1914, although the curve for the last six years is concave upwards, *i.e.*, it is getting steeper. Nevertheless, even the cotton trade fluctuates, and if the increase is much more rapid than calculated, some form of "Rapid Transit" must come to the rescue all the sooner. At any rate, the curve attains the respectable figure of 450 million passengers in 1934, starting from about 258 millions in 1914.

The difficulties already experienced on the Manchester tramway system are those of congestion on certain routes at the morning and evening rush hours. Piccadilly, London Road, Oxford Street, Market Street, Cross Street, and the Rochdale, Cheetham Hill, Stockport and Oxford Roads are, as shown by diagram No. 51, carrying a large number of cars per hour. None of the streets in the central area lend themselves to the purposes of a tramway terminal—Manchester has nothing corresponding to Liverpool's Pier Head—and the immediate problem is therefore to relieve this central congestion.

The proposals put forward to this end are bold, and will be effective if they are carried out. What to do with the old Infirmary site has been a Manchester problem ever since the old Infirmary was vacated. Mr. McElroy says: make a tramway terminal and an open space of the bulk of it; build a fine and commodious Tramway Department office on the rest. These are good ideas. But a tramway terminal requires outlets and inlets; especially will the Infirmary terminal require additional connections on the east. So it is proposed to extend Aytoun Street into London Road, joining it near the crossing of Fairfield Street, with a new street branching from Auburn Street into Whitworth Road, opposite Temple Street, so relieving London Road and Piccadilly of a large part of the tramway traffic. Of slightly less magnitude is the proposal to lay out Albert Square as a terminal roundabout, and to cut a new street from Albert Square into Oxford Street, lining up with that street. This will be recognised as a great improvement in the chief tramway route from the southern districts. It is further proposed to lay out terminal loops in Corporation Street, Marsden Square and Stevenson Square, to accommodate the traffic from the north. With these bold improvements carried out, the carrying capacity of the tramways will be very greatly increased, the central loading and unloading accommodation should by these means equal as many cars per hour as the lines can reasonably carry, and the effective speed of the cars in the central area will be appreciably increased. Other traffic will naturally benefit by the transfer of the loading and unloading places to definite positions off the main lines of thoroughfare, and there should be fewer accidents to passengers. It may be that passengers will sufficiently appreciate the convenience and safety of such terminals as to tolerate fewer stopping places in the streets near them—this result has occurred in some foreign towns—which will further improve speed conditions in the central streets for all classes of traffic.

Various street widenings are proposed, and special emphasis is laid on the necessity of providing for the large increase of population which is in progress and in prospect on the south side of the city, as well as providing better north and south routes across the centre. The desirability of more complete co-ordination between the Manchester and the Salford tramways is also suggested, and it is obvious that such arrangements ought to be possible and ought to be made, as will give to the public of Manchester and Salford facilities as good as if the two systems were under one management.

The report points out, quite correctly, that with the improved central terminals the arrangement of routes terminating in the centre, and of routes running across or through the centre, can be settled on consideration of the traffic requirements only, whereas at present through routes are in many cases run to avoid the troubles of "dead-ends" in the central streets, but result in a lessened effective use of the rolling stock.

Some investigations into the "loading characteristics" on certain Manchester routes, and on cars running throughout the day, are of more than local interest, and provide an effective negative to the suggestions which have been put forward in certain quarters recently, that vehicles of much smaller carrying capacity are capable of superseding the tramcar vehicle-mile for vehicle-mile. They are used in the Report to show what volume of traffic has to be provided for now, and inferentially that the routes must be improved and supplemented to keep pace with its future growth.

Then come the crucial questions: What will all this cost? and how is the cost to be met?

To the first question, what will it cost? the Report offers no answer. It is easy to understand Mr. McElroy's reluctance to enter on estimates which involve valuations of a large amount of property, as well as the construction of new streets and all their paraphernalia, and such matters as betterment; and perhaps, what is the most difficult and momentous point of all—how the cost is to be allocated—and he has no doubt wisely confined himself to showing what amount of net revenue may be available from the Tramways Department, if it is kept abreast of the requirements by the improvements proposed. The net result is that—provided the contribution in relief of rates is restricted to £100,000 per annum, that no drastic reduction of fares takes place, and that the work is spread over a series of years—the tramway revenue can bear an expenditure of £1,000,000 on this object. This seems the sensible way of facing the matter, for it is indisputable that the city will benefit in many other ways, and to a very considerable money value, so that it is better to put on the tramways what they can bear, than to charge them with an excessive amount, or to reject the whole scheme because it cannot be shown that the tramway revenue can carry the whole cost. To show that there are other benefits to the Municipal funds from similar improvements, Mr. McElroy cites the case of a street improvement which cost £147,000, and resulted in an increase of rateable value from £16,663

to £57,594, so that whilst the interest and sinking fund amount to £6,000, the increase in the rates received is about £16,000 per annum; a very heartening example, which shows incidentally that the owners of the sites and buildings must also be getting greatly increased revenues.

These questions involve social and political issues which, unfortunately, elicit keen differences of point of view, which will have to be fought out in the Manchester City Council, and in Parliamentary Committee Rooms, when the schemes get that far, as it may be hoped they will. It is very unfortunate that in this country we cannot follow the procedure of New York and Boston in getting these matters settled by an *ad hoc* expert body, who regard only the public interest; and that here every kind of private interest can oppose and delay. The private interest ought to be fully heard and fairly dealt with in respect to compensation, but never permitted to obstruct.

No community suffers more from our unfortunate procedure than London. Not only private interest, but party political spirit, has blocked the adoption of any of the recommendations of the Royal Commission on London Traffic, with the result that although the London Transport systems have grown enormously in extent, in capacity, and in public utility during the last decade, it is obvious that the money spent has been largely wasted, that it has neither provided the facilities which—under proper co-ordination—it could have done, nor is it yielding the profit which capital laid out in public utilities may fairly look for.

Mr. McElroy emphasises the lessons from foreign cities already quoted, and also the necessity of protecting the tramway revenue in Manchester from such unregulated competition as has occurred in London.

Whilst the development of the tramway system is the immediate solution to the Manchester problem suggested by the Report, other means of transport are not ignored. The motor omnibus and the trackless trolley are seen to have very useful and important functions to fulfil in a complete system, and the promise is made of concrete proposals for their use in Manchester. This is obviously the sane and balanced view to take, and it must be admitted that an important compensation for the disadvantages of the London traffic position (only the compensation and the disadvantages are not realised by the same people in an equitable degree) has been the development of the motor omnibus, which can now be reckoned with on definite estimates of earning powers, cost, and reliability.

Finally, the Report suggests, Rapid Transit routes to supplement the tramways will become necessary in order to reduce the time of transit, and also to deal with traffic diversities beyond the capacity of any surface methods.

Strong preferences are exhibited for the shallow subway, and if cost is unimportant, there can be little doubt of the force of the reasoning, backed by the experience of such places as New York, Boston, and Paris. But expenditures of £500,000 to £700,000 per mile of route require a great deal of justification in the shape of traffic prospects, and it may be some time before any British municipality proposes such a scheme. The author recalls the fact that two underground schemes for Manchester have been privately promoted within recent years, and expresses the opinion that neither of them was on a proper route. He does not, however, adumbrate definite proposals of this kind, reserving their consideration for the future.

In conclusion, this Report can be recommended as a careful study of a problem which faces every large city in the country, as a concise statement of what has been done in other places, and with what measure of success, and of an application of the general lessons and general principles to a particular case, and as an indication of certain changes in our Municipal and Parliamentary procedure needed in order to facilitate the solution of the problem on rational lines.

The Manchester Council is to be congratulated on having obtained such useful guidance for its own future course, and Mr. McElroy on having shown his ability in assimilating what he has seen, and applying it with such concise cogency to the conditions which it has been his business to study and to meet. The best wish one can make for him is that he will be permitted to carry out his plans with the minimum delay, and with the minimum interference from extraneous influences.

THE BOKSBURG (TRANSVAAL) RAILLESS TRACTION SYSTEM.

By R. TURNBULL MAWDESLEY.

The town of Boksburg is situated on the Witwatersrand, about 16 miles east of Johannesburg. It is one of the most important gold-mining centres on the East Rand, with a white population of about twelve thousand.

The native population is much larger, and fluctuates a great deal; at the present moment, the number borders upon 40,000, mostly Zulus and Shangaans, who are recruited from the outlying districts and employed by the various mining companies. Notwithstanding this host of semi-civilized Kaffirs, there is a great shortage of native labour, brought about by the recent Labour troubles, which affected this particular part of the Reef to a great extent; this means in its turn that not so many white miners are employed.

The town has long been without means of transportation within its borders, if we except some ancient mule-drawn vehicles, which plied between

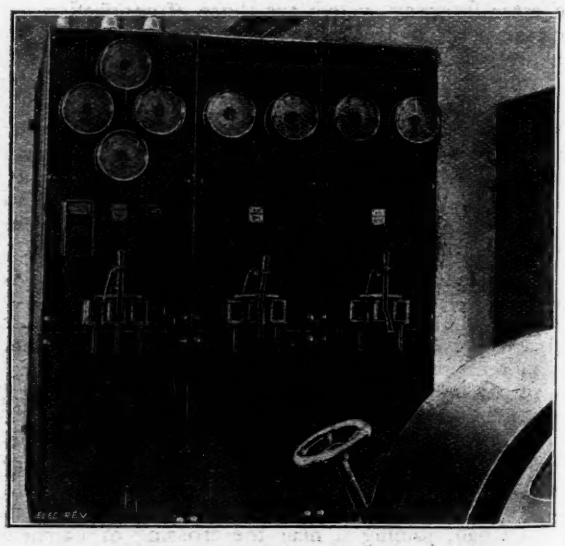


Fig. 1.—High-Pressure Switchboard.

the various mines on the borders, and the shopping district of the town.

The East Rand Proprietary Mines, Ltd. (the moving spirit in which is Sir Geo. Farrar) own a vast amount of mining rights in this area; their employés form the major portion of the population, both white and coloured, and it will be readily understood that the town's prosperity depends wholly upon mining activities.

After discussions in the Town Council, which lasted some two or three years, it was decided that

a system of railless traction should be adopted, and finally preference was given to the K.E.T. Co's. system. An order was therefore placed with this company to supply the first six cars, and these were erected at Boksburg under the supervision of Mr. Jeffs (who came out for the R.E.T. Co.), in conjunction with the South African agent.

Exhaustive trial runs of all the cars have been made, and the motor-men, who are all, of course, new to this system, have been given ample opportunities for practice driving, and for familiarising themselves with the various routes. The trials have given complete satisfaction to the authorities in regard to the chassis and equipments, and the maximum speed of 20 miles per hour has been attained, though this high speed will not be reached in ordinary service.

The municipal authorities are not sanguine about the present profits from the undertaking, but the tradespeople are wholly optimistic, and foresee an increased business in the town when the cars commence to run. The general business of the town has

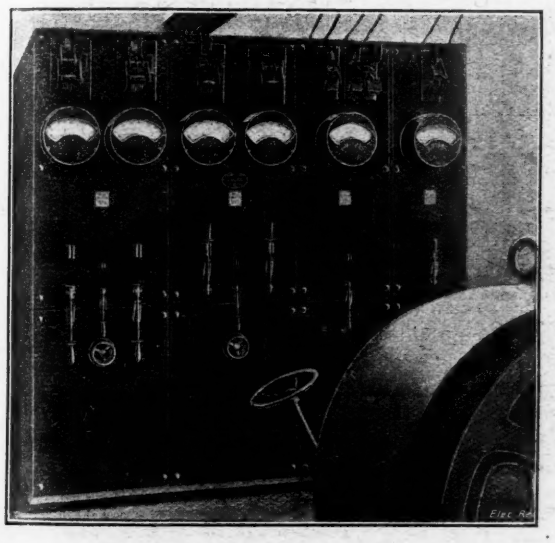


Fig. 2.—D.C. Switchboard.

lately been somewhat somnolent, owing to the shutting down of one of the principal mines—the Cinderella.

The municipal authorities, in consequence, recently found it necesary to retrench the town clerk and the town engineer, and the work of the latter's department has fallen upon the shoulders of the electrical engineer.

Boksburg is one of the principal pleasure resorts on this part of the Witwatersrand, and possesses one of the few sheets of water which can truthfully be called a lake, where the only boating accommodation on the Rand can be obtained, and it is fondly hoped that the somewhat decaying business of the town may be revived by the advent of the cars.

This is the first railless traction system to be seen in South Africa——though the neighbouring town of Germiston is proceeding with a railless equipment of somewhat different construction.

The plant is, of course, necessarily quite small, and only six cars are to be put in service at present; but for this reason alone, the adoption of a railless system proves interesting.

The Brakpan Power Station of the Victoria Falls and Transvaal Power Co. is in the immediate neighbourhood, and a 10,000-volt 3-phase line supplies a transformer sub-station at Boksburg—from which sub-station a 2,100-volt supply is taken for the lighting of the town. There are some nine transformers distributed throughout the town, fed by the above 2,100-volt supply, and from these a 230-volt 3-phase supply at 50 cycles is taken for lighting and power.

A 2,100-volt 3-phase feeder cable runs from the Power Co's. transformer sub-station to the Boksburg Municipal Tramways sub-station, which contains two Bruce-Peebles motor-converters of the standard two-bearing type, each of 150 kw. capacity, and running at 750 r.p.m.

The converters deliver direct current for the cars at 500/575 volts, and synchronising is very easily accomplished by a variable resistance in the rotor circuit. The whole of the switchgear is exceedingly simple.

In addition to the converting plant, Messrs. Bruce Peebles obtained the contract for the switchgear, which was sub-let to Messrs. A. Reyrolle and Co. The H.T. gear consists of one feeder panel and two converter panels, with oil switches and the necessary overload attachments, and is placed on a slightly raised platform facing the converters.

The direct-current gear consists of two generator panels, two feeder panels and two circuit-breakers coupled direct to the D.C. bus-cars, for supplying the car sheds.

This gear was erected by the South African representative of Messrs. Bruce Peebles, who, of course, carried out the erection of the motor-converters.

The severe lightning storms which are encountered in this country have made it necessary to install a fairly large number of lightning arresters on the trolley lines, and all frames of switchgear and converters are " earthed " by copper conductors.

The overhead equipment is of the ordinary double trolley wire construction, on span wires, and there are some four miles of this already completed; a further two miles of single track construction on side arms is being carried out by the electrical engineer.

There is no protection against lightning upon the cars themselves, the protection on the trolley lines being considered sufficient to safeguard the cars—but the passengers' grab-handles are effectively insulated from earth.

For the present it is proposed to run only two shifts at the sub-station, and the operating staff consists of a skilled man on each shift, with an unskilled helper.

The cars themselves are of the single-deck type, with one front entrance, and will be operated by a driver only on the " Pay-as-you-enter " system, much in vogue in Canada and the States, but it is

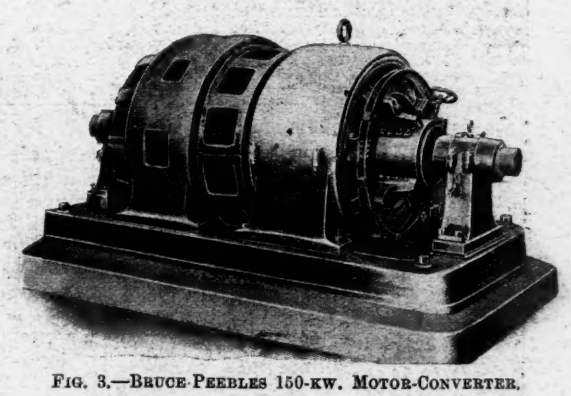


Fig. 3.—Bruce-Peebles 150-kw. Motor-Converter.

the writer's opinion that the driver's time will be fully occupied in steering and avoiding obstacles, and in stopping and starting on picking up passengers. The " Pay-as-you-enter " system would appear to work satisfactorily when applied to railed cars, where no effort of the driver is needed to steer, but it remains to be seen if this system will be satisfactory on railless cars.

The car bodies were built by Messrs. Milnes, Voss and Co.; the electrical equipment is by Messrs.

Siemens, and consists of two motors, with the usual forward and reverse series-parallel control.

The field current of the motors is shunted when the controller handle is on the last notch which gives acceleration to the car, but this gives the unnecessary speed of 20 m.p.h. which will not ordinarily be reached.

The seating capacity is 28, apart from the driver, and no natives will be allowed to ride, unless they are servants accompanied by their employers. There was a proposal to attach trailers for native passengers, but this is in abeyance.

The cars will at present serve the districts of Vogelfontein, Boksburg North, the East Rand Mines, Married Quarters, and Main Reef Road, connecting these districts with Boksburg Central Town.

The total cost of the undertaking has bordered upon £26,000, which amount was raised by the sale of municipal lands, and the work has been carried out by Mr. W. S. Guilford, the town electrical engineer.

The chief lack of the Council, and one which has every indication of being remedied, is a municipal power station. As previously mentioned, the present supply, both for traction and lighting, is taken from the V.F.P. Co.; their charges certainly border upon the high side, and are considered exorbitant by the Boksburg authorities. The cost per unit for power purposes in Johannesburg is three-halfpence, but the V.F.P. charge, in this case, no less than 2.85 pence delivered at the Council's sub-station. Therefore the cost per unit to the Council, after the sub-station maintenance and operation charges, is certainly high, and it is considered that the V.F.P. Co. should modify their rates.

The writer's thanks are due to Mr. W. S. Guilford, the electrical engineer, for facilities granted in the taking of the views, and for details embodied in this article.

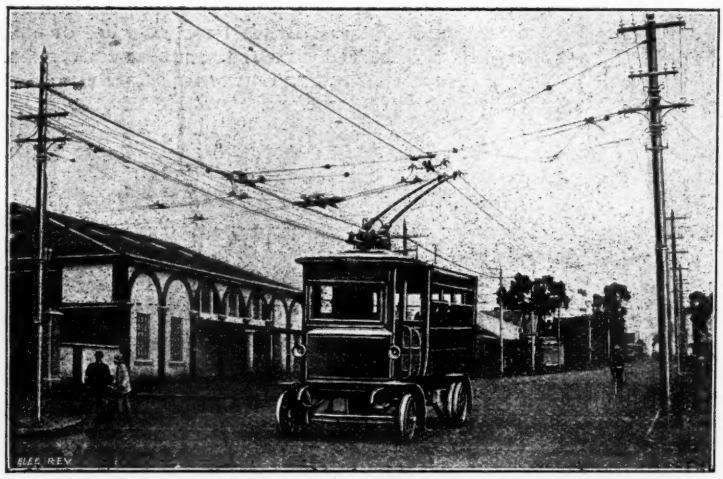


Fig. 4.—Car and Overhead Equipment; Car-Sheds on the left.

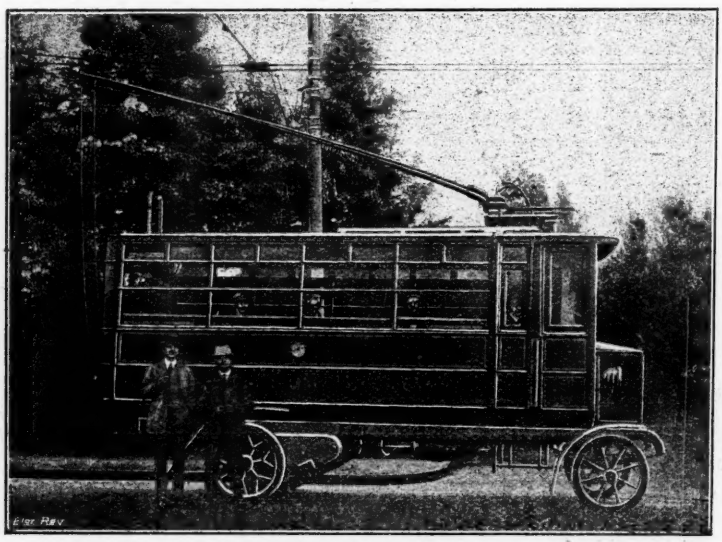


Fig. 5.—View of Car, showing length of Trolley Pole.

THE ENERGY OF X-RAYS.

The energy of the X-ray formed the subject of a paper read by Mr. A. T. Beatty, B.E., D.Sc., at the meeting of the Röntgen Society on April 7th. Dr. Beatty, who has been conducting some researches upon the transformations which take place during the handing-on of energy from the cathode rays to the X-rays, said that as anti-cathode for the X-ray tube copper was three times as efficient a radiator as aluminium. This relation, however, only applied when the cathode rays were of a low speed; when cathode rays of a higher speed were driven through the tube a new phenomenon came into play in the shape of the characteristic copper radiation, or the fluorescent radiation, as it was called. When this fluorescent effect was observed, the copper anti-cathode gave off a still more powerful stream of X-radiation as compared with the aluminium. If, in the path of this copper radiation, a sheet of aluminium were placed, the fluorescent part would be cut down to a greater extent than the general radiation, the result being that the copper became relatively less efficient than before. With the use of sheets of aluminium of a certain thickness, the fluorescent element could be cut off almost entirely, and when this was done it was found that the efficiency of the copper reverted to the same relation as before, namely, three times that of the aluminium. It might be said, therefore, that copper was always three times as good a radiator as aluminium, but superposed upon this greater efficiency was the fluorescent effect due to secondary radiation from the copper itself. This fluorescent radiation was not obtained at the expense of the general X-ray radiation, but was an effect entirely superposed. Coming to the second part of his subject, Dr. Beatty described his attempts to measure the actual amount of energy transformed from the cathode beam into X-radiation. By a device comprising an electroscope and resistances, he was able to balance the cathode current against an ionisation current, and make a number of interesting measurements. In the result, using a platinum anti-cathode, Dr. Beatty estimated that for every thousand units of energy in the cathode-ray stream, five units were obtained in the X-rays. With only five parts utilised in X-radiation, the rest must go to produce ions in the metal of the anti-cathode itself.

In the subsequent discussion, Dr. G. W. C. Kaye pointed out that Dr. Beatty's interesting conclusions were based upon the assumption that if one took the trouble to absorb the X-ray completely, the ionisation effect thus obtained was a total one, and was a direct measure of the energy of the X-ray passing through the gas which acted as the ionisation medium. The work of some recent experimenters, however, was rather against this supposition, and he thought that the assumption that the total ionisation was a measure proportional to the X-ray was a very questionable one to make. Asked by another speaker as to the relative values of a tungsten and of a platinum anti-cathode for the X-ray tube, Dr. Beatty said that, supposing no fluorescent radiation was produced, the effect would be directly proportional to the atomic weights of platinum and tungsten respectively, namely, 195 and 184. But then the characteristic radiation of the metals themselves would come in, and the greater the atomic weight of the element the greater would be the fluorescent radiation. On the whole, on theoretical grounds, he thought platinum the more efficient.

LEGAL.

Potter & Co. *v.* Berg & Co.

In the Shoreditch County Court, before his Honour Judge Smyley, K.C., recently, Messrs. F. W. Potter & Co., of Phipp Street, E.C., electrical motor manufacturers, sued Messrs. J. Berg & Co., of 169, City Road, E.C., to recover £5 17s., being the balance of an account for a ½-H.P. electric motor supplied. It appeared that the plaintiffs supplied four motors, three of which should have had grease lubrication and one oil. The three that were run with the grease correctly had turned out to be perfect, but the fourth had been lubricated with grease, which had spoilt the running. It was returned to them in a dirty condition, and they were willing to allow £2 for it. They, therefore, asked for the balance due for the cost of the motor as supplied new, less the £2 they were willing to allow on it.

Mr. Henry Francis Joel said it was clear that the motor could not have been looked after worse. They had had about 5,000 of them through their hands, and had never had a complaint before. He admitted that a new armature had to be put on, but that was caused through grease being used for the lubrication instead of oil; it had nothing to do with the manufacture.

For the defence, Mr. Berg gave evidence, and said he was an electrical and mechanical engineer, with 20 years' experience. He had had dealings with the plaintiffs before, and on this occasion ordered four motors. He had spent a great deal of time in trying to get this to go right, but it would not. He lubricated it with petroleum grease, but that, he thought, had nothing to do with the bad working, and he ascribed it to it being badly put together.

Mr. A. E. Robinson appearing for the plaintiffs, pointed out that the motor was specially constructed to be lubricated with oil, and for that purpose were provided with an oil pot. He had an expert present who would say that a machine built to be run with oil, could not be called faulty if run with grease. The other three which had been run with grease, which they were built for, had turned out perfect. So far as using grease on the fourth one was concerned, they might just as well have used sawdust.

Defendant: It did not go with either grease or oil. Defendant went on to say that they used petroleum grease, very fine, like vaseline, specially made for fine lubrication.

Judge Smyley said this motor seemed never to have been treated with proper lubrication, as it was built for oil, and grease had been used. There would be judgment for the plaintiffs with costs.

Reduced Tramway Profits—Motor-Omnibus Competition and Rates.

In the Court of Appeal, on the 8th inst., composed of Lords Justices Vaughan Williams, Kennedy and Swinfen Eady, judgment was delivered upon an appeal by the Islington Assessment Committee from a decision of a Divisional Court (Mr. Justice Bray and Mr. Justice Lush) making absolute a *rule nisi* which had been obtained at the instance of the London County Council for a mandamus addressed to the appellants, calling upon them, under Sec. 47 of the Valuation (Metropolis) Act, 1869, to appoint a valuer to make a provisional valuation list showing the reduction in the rateable value of the County Council electric tramways situate in the Borough of Islington, arising, it was claimed, from the competition of motor-omnibuses. In 1912 and 1913 the gross receipts from the tramways fell from 11·42d. per car-mile to 9·05d., and a requisition was, on April 4th, 1913, served by the L.C.C. on the Islington Borough Council, as overseers of the parish, requiring them to send to the Assessment Committee a provisional valuation list showing the reduction in the rateable value of the tramways, on the ground that they had been reduced in value within the meaning of the section. The Borough Council refused to accede to the requisition, and, on an application by the L.C.C. to the Assessment Committee, that body came to the conclusion that there was no *primâ facie* evidence of such a reduction as was contemplated by the section, and they therefore declined to appoint a valuer. The Divisional Court, however, ordered that the mandamus should issue directing the Assessment Committee to appoint a valuer. The Assessment Committee appealed, contending that in order to justify the making of a provisional list on such a ground as competition of motor-omnibuses, there must be such a "continuous" reduction in value as to show that the letting value of the hereditament had been lowered, and no such continuous reduction in value had been shown in this case. Next, an alteration in value within Sec. 47 must be something special to the hereditament in question, or to the particular locality, whereas here the alleged cause of alteration in value was a cause operating throughout the whole of the metropolitan area. Further, it was said the Divisional Court were wrong in holding that the reduction contemplated by the section was a reduction in the value for the year in which the requisition was made, as compared with the value in the preceding year of the quinquennial period. The comparison, it was argued, ought to be with the value in the year in respect of which the quinquennial valuation was made.

Sir Robert Finlay, K.C., Mr. Ernest Charles, K.C., and Mr. Arthur Page appeared for the appellants; and Mr. Ryde, K.C., and Mr. E. M. Konstam for the respondents.

The judgment of Lord Justice Vaughan Williams (absent through indisposition), who dissented from the other members of the Court, was read by Lord Justice Kennedy. The effect of the refusal of the overseers to send in a provisional valuation list was, said Lord Justice Vaughan Williams, to bring into play sub-Sec. 2 of Sec. 47 of the Act of 1869—that was to say, to cast upon the Assessment Committee the duty to "appoint a person to make such provisional list in the same manner as in this Act provided in the case of overseers failing to transmit a valuation list." The Assessment Committee contended that this duty arose only on the happening of a condition precedent—viz, if the Assessment Committee were satisfied that in the course of the year the rated hereditaments had been reduced in value by some cause of a permanent kind; and that if the Assessment Committee had come to the conclusion that no reduction had been shown in this case by the L.C.C., the rule for a mandamus ought to be discharged. He, however, preferred to follow cases in which it had been laid down that, if the requisition stated a *prima facie* case, that was a sufficient compliance with the condition precedent contained in the preliminary words of Sec. 47:—"If in the course of any year the value of any hereditament . . . is from any cause increased or reduced in value." A *prima facie* case meant, in his opinion, a case in which the evidence given was such as to raise a presumption of proof unless qualified or contradicted by other evidence. In his view all evidence of values in the different years of the quinquennial period before or after the date of the suggested alteration was admissible upon the question whether the alteration under discussion was an alteration affecting the value of the hereditament or a mere temporary trade fluctuation. It seemed to him that the Assessment Committee did not in fact deal with the question whether the acquisition disclosed a *primâ facie* case of alteration in value, but rather whether the conclusion of one rating expert or the other was to be preferred. That to his mind was a question to be decided not by the Assessment Committee or the arguments of experts on the figures, but by the valuer whom the Assessment Committee were bound to appoint if the requisition on its face made a *primâ facie* case of alteration in value. The Divisional Court had found that a *primâ facie* case was made out. He thought that that finding was correct, and that it was a finding in law. In his opinion, therefore, the appeal should be dismissed.

Lord Justice Kennedy said he had come to the conclusion that the appeal should be allowed. He thought that under Sec. 47 the Assessment Committee were not only entitled but bound before appointing a person to make a provisional list upon the requisition of a ratepayer, who alleged a reduction in value as the ground of his requisition, to see that there was a *primâ facie* case for the existence of such a reduction in value as the statute prescribed as a condition. If a person was appointed by the Assessment Committee to make a provisional list, his function was simply to make a provisional list, upon the assumption that an increase or a reduction (as the case might be) in value from a cause within the meaning of the first words of Sec. 47 had been shown, to the extent of a *primâ facie* case, to the satisfaction of the Assessment Committee who appointed him. Unless there was proof of error of some sort or degree, the Court ought not to interfere with the conclusions of the Assessment Committee upon matters of pure fact. Where the rateable value of a hereditament was based upon the power to earn profits, an increase or a decrease in the capacity of the hereditament for earning profit was sufficient to constitute an alteration in value within Sec. 47, provided it was due to a cause which directly affected the assessable value of the particular hereditament, and was not of a merely temporary nature. But an increase or decrease in receipts was not sufficient evidence of an alteration in value if it was indicative only of a fluctuation. He thought that in the present case the appellants rightly came to the conclusion, whether it were treated as one of law or of fact, to refuse to appoint a person to make a provisional list. Having referred to the figures, his Lordship said that in his opinion the appellants were right in coming to the conclusion that the respondents had failed to make out a *primâ facie* case of a reduction in value resulting from a cause of a permanent nature, or in terms applicable to the circumstances of this particular hereditament, that they had failed to show that the proper inference from the alleged diminution of earnings in the year 1912-13, as compared with the earnings of the year 1911-12, was such a regular falling-off in the receipts owing to the competition of motor-omnibuses, as would render it unreasonable to suppose that a yearly tenant would give the same rent for the property, taking one year with another. The thing to be shown by an applicant asserting a diminution of value was that within the preceding 12 months an alteration had taken place which rendered the quinquennial valuation of the hereditament, made, say, three years before, an excessive valuation. If the applicant succeeded in showing this, he became entitled to have a provisional list made which fixed a valuation altered to the extent to which he showed that the value had been altered by something which had diminished the value of the hereditament during the preceding twelvemonth. He was not at liberty to bring into the assessment any earlier alteration which might have occurred. He could not be heard to say that the quinquennial whatever was incorrect at the commencement of the 12 months' period. The figures only showed a trade fluctuation which to some extent perhaps was to be accounted for by the electrification that had been going on and the dislocation of traffic in consequence. The ultimate result, however, might be to increase the earning power of the tramways. He considered that the appellants were justified in coming to the conclusion that no permanent reduction had been made out such as would warrant the appointment of a valuer.

Lord Justice Swinfen Eady agreed with Lord Justice Kennedy.

By a majority, therefore, the appeal was allowed with costs, and the rule discharged.

It was intimated that the case would probably be carried to the House of Lords.

War Office v. Kirkland & Capper and J. H. T. Woodd.

(*Continued from page 653.*)

Mr. Thomas Kirkland, continuing his evidence, said he had no doubt at all that under the specification he was working under, he was authorised to put in the installation in the method in which it was put in. On January 2nd, 1906, he recollected an interview with Mr. Woodd, at which he told him that the method of wiring in the tender that the War Office had accepted was by means of vulcanised india-rubber wire in folded tube on the surface, and Mr. Woodd said this would be of no use in the building. Mr. Woodd said: "What can you do for me?" and witness said, "The only thing I can do for you is to put lead-covered wire in on the same lines as at Guy's, and, I believe, as far as my reading of this somewhat complicated specification goes, that I am perfectly entitled to do it." Thereupon he wrote a letter to Messrs. Boldings accordingly. Witness said he examined the wire when it arrived in May, and it was satisfactory as far as he could see by testing. The method of fixing adopted was that of fastening with lead clips on the surface. In regard to the boxes, the specification defined that they were to be standard boxes of iron, and he had these specially got. He got a standard box, and he made them put a piece of mica at the bottom as insulator, and on the top of that he had an insulator of porcelain, and then on the casing of that he had another piece of mica. When the wires were laid from box to box every section was tested before the plaster was put on. He gave instructions as to the use during the plastering of means for detecting any severance of the wires taking place. After plastering, tests were made of each individual section, and he personally tested at the end of the work. When wires were carried round corners, he instructed that the radius of the bend was to be as large as possible, and that they were to see that there were no rough edges against which the wire could be rubbed. These instructions were given to Messrs. Bolding's foreman. He gave instructions to the clerk of the works in effect that he should see that the wires came in, that they were not damaged, that damaged wires were not laid, and that the laying was proper in regard to the plastering. He constantly attended without notice on the works to see that his instructions were being carried out, and he had not spared himself in the slightest regard. After the installation was in, he tested it before the electric light company connected their mains in May, 1907. When he made his tests all the circuits had been put right. After his tests, the Westminster Electric Co. made tests, and these showed that the installation was in complete order at that time, viz., May 27th. He had no intimation that the system as passed by him and by the electricity company was wrong till August, 1907, when it was found that an entrance light was wrong, and Messrs. Boldings had it put right. He heard nothing more till about the end of the maintenance year. Subsequently, when he passed the final certificate for payment, he was of opinion that the work included in the contract had fulfilled all the specified requirements.

In your view, is the system that you have adopted of earthing wires by copping wire lightly wound round them one that is capable of, and proper for, earthing the lead wiring?—In my opinion it is so. He had found no disadvantage from not having glands at the boxes. He considered that none of the alleged defects found were to be attributable to the system that he installed. After an inspection of the whole, and after ascertaining the results of all the tests, he arrived at the conclusion that while the system was not then satisfactory in many respects, he could find no reason for holding himself responsible in any degree for its present condition.

Cross-examined further, Witness said it was more expensive to use lead in plaster than the system of folded pipe on the surface. He had heard that the War Office effected alterations during the year of maintenance, but he was not called in to advise or to take any part in regard thereto.

Cross-examined by Mr. Gordon Hewart: His attitude was that in putting in the lead-covered wires in the way that he did, he was doing what was allowable under the contract, and was really carrying out the contract as it was allowed by the specification.

Do you contend that the lead-covered wires buried beneath plaster were accessible:—Yes; in the technical sense most distinctly.

The Judge: Let me understand. If you have the conductor carried in a metal tube, if your installation fails, and there is a fault half-way along the tube, how do you get at that fault?—You pull the wire out.

Then the wire is accessible?—So is this.

Counsel: How would you get to the wire here?—First of all for accessibility you must be able to get at the ends to test.

I am speaking of the length of the wire. Having got at the ends, we will assume you find a defective wire?—What you do is to cut the ends off, then you simply make a small chase in the plaster from one end to the other. You lay a new wire in and make good.

Is that what you mean by accessible?—Yes, it conforms to accessibility.

You leave your original wire derelict in the wall, having cut off each end of it; you cut up your wall and make a new chase, put in a new wire, and then make good?—Yes.

The Judge: Do you say that is a conductor being accessible?—I do. I consider that is very good accessibility.

Further cross-examined, witness said that at Guy's Hospital half the work was in conduit casing or other method than lead-covered wiring. At the time the lead-covered wires were put in they did not put them in connection with iron boxes. The covering of the connector boxes was in wood; in regard to the insulated part, porcelain was used. He was not aware that the lead-covered wires at Guy's had caused great trouble.

Counsel suggested that in one case, from the fuseboard to the first connecting box in the corridor, the approximate length of the lead-covered wire was 80 ft., and witness said he would accept that statement. He would not dispute that there might be lengths of 60, 70 or 80 ft. of lead-covered wire buried in plaster.

What was the nature of the protection you provided for these conductors so that they might resist nails?—It was that they were put in places where this risk did not arise. And also to protect them with plaster. In certain cases he put them into folded tube down to the plugs.

Mr Gordon Hewart suggested that the connector boxes used in this were not proper boxes for lead-covered wire, and witness expressed the view that they were very satisfactory. He discarded some, and had these got ready for him with proper insulated bases before he approved of them. The boxes might have been designed to receive conduits, but they were quite applicable to receive lead-covered wires as well.

In regard to the Frazzi blocks, Counsel suggested that if they left out ceilings and regarded walls only, there were only 85 points in the whole work where the Frazzi blocks in any way interfered.—Witness said he could not speak of his own knowledge of this, but he agreed if this was the case that as far as walls were concerned, Frazzi affected about 10 per cent. of the total number of wiring points.

Counsel proceeded to deal at length with the letters, and suggested that when the Treasury counsel wrote to say that the ground of the War Office claim was substantially that the defendants allowed lead-covered wire to be laid direct in the plaster contrary to the contract, and that that constituted gross negligence on the part of a firm of electrical engineers whose duty it was to protect the interests of the War Department, the defendants did not reply that the work was in accordance with the contract and did not answer the question put to them as to who suggested the lead-covered wires.—Witness said the matter was in the hands of his solicitors and he accepted their advice as to what was to be done. He kept himself acquainted with the successive wiring rules of the Institution of Electrical Engineers, and was aware of the rules that read: "Unenclosed lead-covered conductors must be supported continuously or at intervals sufficiently frequent to prevent perceptible sagging, and must not come into contact with damp or new brickwork or plaster." On his experience of lead-covered wiring, he did not agree with that rule; it should be altered to allow of lead-covered wiring being buried in plaster.

Re-examined by Mr. Walter, Witness expressed the view that it was not desirable to draw lead-covered wire more than necessary into tubing. In regard to the boxes, he did not think from his experience there was any necessity for filling-up the holes in the box round the lead wire. The small amount of damp that could get in in that way was negligible where india-rubber-covered wire was used.

Mr. Francis Henry Nicholson, A I E.E., resident engineer at the King's College Hospital, Denmark Hill, said he was formerly with Kirkland & Capper, and in February, 1910, he was instructed by the firm to attend with Mr. Kirk and make complete tests of the whole of this installation. The tests took about four weeks. After giving detailed evidence at great length, Witness said that he traced down the defects in every case except as to two, to sections of wires that ended in flexible or wall plugs.

Mr. Walter: In your experience, is it at one or other of the points that you have indicated that faults nearly always originate?—Yes, it is very liable to be so where fittings of that kind are used, as they are handled by everybody.

With the fuses that you saw in position on those boards, in your view could the insulation be injured by over-heating?—Yes. My opinion was that those fuses gradually warmed up the lead-covered wire, and it was a question of time, not necessarily of the actual fault itself, that damaged those wires. If those actual faults had been repaired at the time they first occurred, those wires would never have been damaged.

In the course of subsequent detailed evidence, Witness said that in properly supervised installations, long before a fault had developed, one made periodic tests on each of the circuits at intervals to see what the insulation of the circuits was.

Is there anything in this that led you to the conclusion that the defects in this system were due to the installation of lead-covered wire?—No, it led to the very reverse. If the lead-covered wire had gone by abrasion, as they said, he should have found the defects shown in both buildings and in both parts of the lead-covered system—that was to say, between the boards and the first connector box as well as between the point and the last connector box, but he did not. He found nothing to cause those defects except the bad maintenance, and that was proved by the fact that it came down to practically flexible fittings and over-fusing. He never saw, the whole time he was there, any abrasion of any lead-covered wire at all.

The Solicitor-General: Do I understand that you suggest that what caused this lead-covered conductor to give was the fact that the wires got overheated through too strong a fuse being put in?—Yes.

From the connector box to the flex if the insulation of the lead-covered conductor was going to be affected by excess current, it would affect it through its whole length equally unless there was some defect in the insulating surface?—Certainly.

Unless the insulation had perished its whole length there would be no fault in the lead-covered conductor?—That is so.

Referred to the two pieces that were cut out on the Saturday from the circuits where faults were found, witness said the rubber showed signs of overheating, but he could not say if that overheating had perished the insulation without testing the wire. Witness agreed with Mr. Patchell that the signs of overheating

were signs in one wire alone of the two. If that was so it was clear that there had been a dead earth on the circuit, and therefore the fault was one that would have been extremely unlikely to have been found in the flex. It would be found behind the plug point, and if not there, it must have occurred in the lead-covered conductor, but not necessarily buried in the plaster.

After a long cross-examination on these points, Witness agreed that on the lead-covered conductor that he tested there had been a leak to earth. He first formed the view that the mischief in the system was due to overfusing when he saw the heavy fuses, because when one began to see overfusing in any building one ought to begin to look for trouble. He did not suggest that 7-ampere fuses would have caused the insulation of the circuit to breakdown.

Mr. James Swinburne, F.R.S., next gave evidence regarding the properties of rubber and the functions of the lead covering.

Counsel: If wires are put in lead buried in plaster, when is the period when you would expect to find difficulties, if any, in connection with the insulation, the beginning or at a later period?—I should not expect from burying wire in plaster to have any trouble with insulation at all, if the plaster is going to be dry within a reasonable time—we will say a few months. It is known that mortar, that is to say, lime plaster, if wet, will eat gradually into lead, but it will take a long time to eat through a lead covering, and will only do it while it is wet. Once it is dry there is an end of it.

Assume any action on the lead with the system of insulated wires that you have here with rubber insulation, is there going to be any action on the rubber there?—No, if the lead was eaten through by continually damp mortar, and then the rubber was left long enough for it to perish, when the rubber perished you would get trouble, but I see no reason to expect trouble until that happened, and it would be a matter of years; it would not be an immediate matter. In all cases defects were in the last sections between the lighting point and wherever the previous opening was. The fact that the defects were found there showed that the probability was that it was not in the buried wire at all that the leaks occurred, but in the connections.

Witness, in subsequent evidence as to the fuses being heavier than the circuit was normally supposed to carry, said that the large fuses did not cause faults or tend to cause faults at all. They permitted leaks to go on that should be stopped and remedied. Where a normal fuse went, that showed there was something wrong, and it was the business of the man in charge then not to put in a larger fuse, but to find out what was wrong and remedy it. Installations might be completely ruined, although perfect in the first instance, by negligent supervision. If an installation was perfect, you could put in enormous fuses and no harm would ever happen, but no installation was perfect, and the fuses were put there in order that if a fault did develop anywhere they might know it was there and put it right.

Mr. Walter: Do you find in the reports, and the evidence that you have heard, any proof relative in this case that the system as installed failed by reason of lead being put under plaster?—No. I have not found that. I think the trouble must have arisen from points where you are making connections with the wires. I can see no reason why the lead buried in plaster so far as that goes should not be absolutely satisfactory.

The Judge: You now assume a perfect piece of lead-covered wire put properly into plaster, you say when once that is dry you see no reason why it should not work properly?—I go a little further than that; the lead ought to be perfect, but if a crack or something of that sort occurs in the lead, and it is rubber covered inside, I do not see that that is going to do any harm; with paper insulation it is different.

Asked to define the object of accessibility of wires, witness said what one wanted to be able to do was to test the wire, and if by any chance the wire had gone wrong one wanted to be able to replace it; one did not want to get at the wire to repair it, one never repaired wire of that sort at all. If the wire was wrong, one took it out and put in another. Enclosing wires in metal conduit always led to damp inside the conduit. The question of getting in new wires simply depended on the length and the number of curves.

Mr. Walter proceeded to ask Mr. Swinburne if, in his view, there was anything in the War Office specification to prevent the use of lead-covered wire.

The Solicitor-General objected, as this (he contended) was a question for the Judge.

The Judge said he could not see that Mr. Walter could put the question he had asked, as he was throwing the specification at Mr. Swinburne's head, and asking him to find his (the Judge's) judgment for him.

Mr. Walter: It is exactly the point I think your Lordship has not to find.

The Judge ultimately rejected the evidence as to Mr. Swinburne's interpretation of the contract.

Mr. Swinburne, further examined, said he would not think of having Frazzi chased.

Cross-examined by the Solicitor-General: It would be correct to say that this system was in a measure restricted and prohibited by the Institution rules. These restrictions would be due to the fact that people had found trouble with the system, and the character of the trouble generally, he would say, would be corrosion of the lead. He agreed that one should not put lead-covered cables like these in plaster in places where people would be likely to drive in nails.

Subsequently, in the cross-examination, Witness was handed a file and asked to chase a Frazzi block, and he did so, admitting that the file acted quickly, and that it was not so tedious as he thought.

Eventually Mr. Swinburne gave evidence at great length on the question of accessibility and other matters.

The next witness was Mr Ralph Gooch Tyler, M.I.E.E. In 1897 he brought out as a trade system the twin lead-covered cable insulated with india-rubber. He induced Henley's Telegraph Works to produce it. They wanted something to get rid of wood casing and corrosion from the action of the plaster. The system had been used in increasing quantity from that date. A list he had prepared of 142 of his more important installations showed four in 1898, four in 1899, seven in 1900, and so on up to 13 in 1913, and he now had nine contracts in hand. They buried the cables where necessary, and it was always necessary in dropping the wires down to a switch or brackets in the wall. The floors they generally escaped by putting them immediately out of the floor boards and simply notching the joists. They always had to go through walls, and they were mortared in or plastered in, and according to his view there was no bare metal that would stand plaster except lead. In ornamental work where such cable had to be run, and where one could not have anything on the surface, it had been his practice during all these years to bury it in plaster. They had had great success with it, and Messrs. Henley's had now brought it out as a complete system for the general trade. Witness said the system had been used for every kind of building that he knew of. He had done Peak Frean's in 1900, and recently they had ordered him to do their new factory at Bedford on the same system. The laying needed care and the method of fastening with lead clips was correct.

Cross-examined: He knew that the Rules of the Institution said that conductors buried in cement or plaster must be provided with sufficient protection to resist a nail. To comply with that rule he had got out a steel channel to place over it where there was obvious danger. It was not the general rule to run the system from the terminal boxes to the lighting points with lead-covered conductors buried in new plaster for the reason that solid ceilings were not the general rule. He thought it was as wise to bury it in the ceiling as in the wall. With regard to the breaking down of the system, the fittings would be by far the weaker point.

Mr. Campbell Swinton, M.I.E.E., said that he introduced lead-covered wiring at Armstrong, Whitworth's for wiring warships over 20 years ago, and it had been adopted throughout the British service and throughout most foreign services, and also generally in the mercantile marine. It was run on the surface as a rule without any protection. There was no difficulty in putting the conductors round bends, &c., and the lead was unprotected, although the insulation depended on the lead being kept uninjured. The lead wire was used by the Post Office for their telephone wires in houses. There was an installation of electric light at the City Corporation lunatic asylum at Dartford, which contained about 1,200 lights, and was entirely wired in lead-covered wire. In regard to the installation at Millbank, he thought it was allowed to get into a bad condition. It was never tested, and when faults occurred no attempt was made to remedy them. The brutal system of increasing the size of fuses was used till they stood, and the result was that the insulation of many of the circuits was damaged Installations could be readily destroyed if faults were not located and the fuses were increased. Witness thought that no other system than the one installed at Millbank could have met the case—that is, at the time in question.

In cross-examination, witness pointed out that his specification had covered lead-covered wires, not twin, but that was the only point.

Mr. Alfred Herbert Dykes, M.I.E.E., said he was authorised by the Committee of the Association of Consulting Engineers, to give evidence on their behalf. Assuming that he was told there were only ⅛ in. of plaster above something that could not be chased and that the system had to be under the surface, in 1905 there was only the lead-covered conductor system that could be used. You could have twin lead covered, or two single wires; twin lead-covered would be the more suitable. It should have given no trouble. He was now carrying out an installation where the wires were buried on blocks similar to the Frazzi blocks, and he used metal-covered wire buried direct in plaster. A few years ago he would have used lead-covered wire. He now used copper-covered wire; this was a modern development, but the system of using was similar. Once the plaster was dry, he had never known any wire to fail through plaster in any case where he had used lead-covered wire. There had been failures in certain cases with certain kinds of plaster, and under certain conditions, but these did not occur where the plaster was either the ordinary lime plaster that was used here, or Keen's cement. Witness said that in any system he should be sorry if the fact that faults occurred in a large electric light system within a year or two after it was finished was taken to indicate that the system was at fault. One always got defects in any large system, and if they were allowed to run on, they developed into larger defects. Witness thought if the trouble was due to the lead-covered wiring being faulty, or a faulty system, he saw no reason why there should not be faults between the fuseboard and the first connector box.

The last witness was Mr. Owen David Lucas, who agreed with the view of the previous witness that the system used at Millbank was the correct one under all the circumstances. It could not have been done in any form of armoured cable. He thought the connector boxes were satisfactory for this sort of installation. He believed there was no special box made at the date of 1905 for lead-covered wire.

This concluded the evidence in the case, and subsequently counsel on each side addressed Mr. Justice Lawrence in summary of the whole evidence.

On Monday, April 6th, Mr. Justice Lawrence was to have heard

legal arguments, but his Lordship was unable to take his seat owing to a cold, and the case was adjourned till the next legal term, which began on April 21st.

THE UTILISATION OF SOLAR ENERGY.

By A. S. E. ACKERMANN, B.Sc. (Eng.), A.M.Inst.C.E.

A PAPER on the above subject was read before the SOCIETY OF ENGINEERS (INCORPORATED), on the 6th inst., by Mr. A. S. E. Ackermann, who has been associated with the work (as joint consulting engineer with Mr. C. T. Walrond, to the Sun Power Co. and the Shuman Engine Syndicate) for nearly four years. The paper is the first of its kind, and deals with the whole of the experiments which have been made during that period, and which have cost about £30,000.

After naming the principal workers in this field, the author gives determinations of the solar constant and deals fully with the varying percentages of this quantity that are available throughout the day for power purposes. He then describes four types of Shuman sun heat absorbers and gives in great detail the results of his trials of these apparatus. The results of these types of absorbers are compared by means of tables and curves, and from these the author has constructed a formula by means of which it is easy to calculate for a given type and size of absorber the total output of steam per hour if three things are known :—(1) The time of day ; (2) the humidity, and (3) the steam pressure. It has been known that humidity adversely affects the quantity of solar radiation arriving at the earth's solid surface, but this is the first time that its effect on solar steam production has been quantitatively determined.

In order to utilise the low-pressure steam economically, Mr. Frank Shuman designed a special engine, which has also gone through several stages. This engine is fully described, with drawings, and the author gives the results of his trials of the several engines and compares their results with those of exhaust steam turbines and the low-pressure cylinders of compound and triple-expansion engines, showing that the Shuman engine is the more economical. The steam consumption of one of these engines was only 22·1 lb. per B.H.P.-hour, when the output was 94·5 B.H.P., and the steam pressure only 16·2 lb. per sq. in. abs.

In the earlier experiments (1907 and 1910) Mr. Shuman employed the direct rays of the sun without any reflecting surfaces ; in 1911 reflectors were used to supplement the direct rays, increasing the heat received in the ratio of 2 to 1. The boiler in this case consisted of a number of flat cells of tin-plate, each about 3 ft. square and ¼-in. thick, aggregating 26 sections of 22 cells each, a total area of 5,148 sq. ft., receiving the radiation falling upon an area of 10,296 sq. ft. The area of land occupied was 126 × 142 ft., rather less than 0·4 acre. Steam was generated at or near atmospheric pressure, the maximum output being over 800 lb. of steam per hour, equivalent to nearly 27 B.H.P., and a rate of absorption of useful heat of 88 B TH.U. per hour per sq. ft. of solar radiation. This was the first absorber constructed on commercial lines.

In 1913 a larger plant was erected at Meadi, near Cairo, Egypt, in which improvements suggested by Prof. C. V. Boys were embodied. In this case the dimensions of the boiler were reduced, and the radiation from a large area was concentrated upon it by means of trough-like reflectors of parabolic section, with their axes north and south. The construction of the reflector is shown in section in fig. 1 ; it consists of thin glass mirrors carried in a light steel framework, which is rotated so as to receive the solar radiation always at the best angle, under the control of an ingenious electrical automatic heliostat.

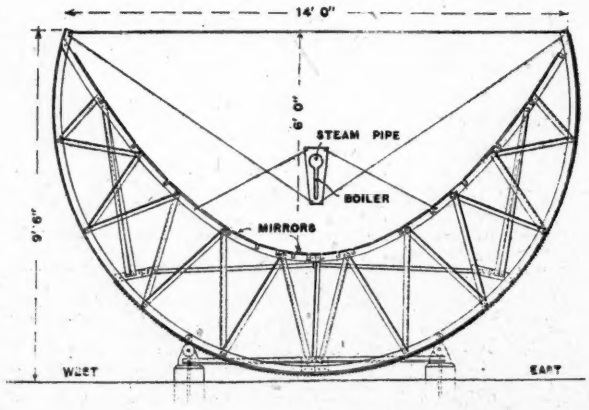


FIG. 1.—CRESCENT FRAME OF SHUMAN-BOYS ABSORBER.

A section of the boiler is given in fig. 2 ; it is made in 4-ft. sections of cast-iron, bolted together in lengths of 205 ft., the dimensions of the water space being ⅝ in. × 11 in. × 205 ft. The boiler is encased, as shown, with glass plates, which enclose an air space round it to prevent loss of heat by conduction and convection ; the casing was not, however, always used in the trials. There were five sections, as above described, the absorber occupying a net area of about 14,400 sq. ft., but as the sections were spaced at 40-ft. centres, the total land area occupied was about ⅓ acre. This might be greatly reduced. The total area of sunshine collected was 13,752 sq. ft., and the net concentration was in the ratio 4·6 : 1.

The amount of steam produced per hour per sq. ft. of solar radiation was 0·12 lb., as compared with 0·09 lb. in the 1911 experiments. The maximum absorption observed was 116 B.TH U. per hour per sq. ft. of radiation collected (compared with 88 in 1911), and the maximum output of steam was 1,442 lb. per hour, at 15·8 lb. per sq. in., on August 22nd, 1913. Allowing for a consumption of 26 lb. per B H.P.-hour, the plant could have developed 55·5 B.H.P. Owing to mechanical defects in the engine and pumps employed, however, the actual output bore no relation to the steam production.

The experiments showed that the production of power by direct utilisation of the sun's radiation was not only practicable, but commercially feasible. In the course of the discussion which

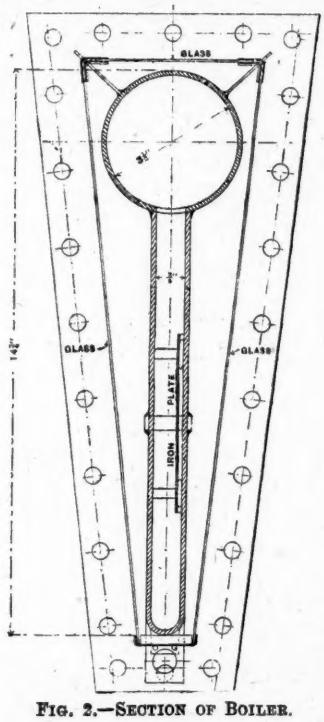


FIG. 2.—SECTION OF BOILER.

followed the reading of the paper, a representative of the Sun Power Co., Ltd., stated that the cost of the absorbing plant was £1,560, or about twice that of ordinary steam-raising plant ; if coal cost 9s. 8d. per ton, the total inclusive running costs would be about equal, but as coal in the tropics costs about 60s. per ton, the sun plant has a very marked advantage. As a result of the experiments the Egyptian Government has ordered a 100-H.P. plant for the Soudan. Seeing that this was the first plant of its kind (with parabolic reflectors), the success achieved is highly satisfactory. Unfortunately such a plant could not be used for electric lighting without complete storage, but it could be used for the supply of electric power in tropical countries under suitable conditions.

Switching Competitions.—On previous occasions we have drawn attention to the electric light switching examinations initiated by Messrs. A. P. Lundberg & Sons, who, as the inventors and makers of a great variety of tumbler switches, are in an exceptional position to deal with the subject of tumbler-switch controls. The operation of switching a lamp on or off seems simple enough ; there is "nothing in it," yet, we understand, there are no fewer than a dozen or more types of tumbler switch available for use in connection with incandescent lamps. Many engineers would be somewhat puzzled if suddenly called upon to enumerate the conditions calling for the use of each of these types. It is, however, one of the most admirable qualities of the electric light that it lends itself to niceties of distant control that are absolutely unique, and it would be a pity to neglect this valuable feature of the system simply to save a little trouble and thought. Messrs. Lundberg, therefore, are to be congratulated upon their enterprise in instituting examinations for the purpose of developing the knowledge of this subject and educating electrical men to a realisation of its possibilities, whereby they are also benefiting the electrical industry as a whole. The results of their latest competition are set forth in our advertisement pages to-day, and it will be noticed that the most successful competitor, appropriately enough, is a member of the Illuminating Engineering Society.

WAGES OF WIREMEN IN THE MANCHESTER DISTRICT.

THE MANCHESTER, SALFORD AND DISTRICT BUILDING TRADES' EMPLOYERS' ASSOCIATION.

Working Rules for Electrical Wiremen and Cable Jointers for Manchester, Salford and District.

1. *Wages.*—The minimum rate of wages for qualified electrical wiremen and cable jointers shall be 9½d. per hour. Any extra for charge-hands to be mutually arranged between employer and charge-hand.

2. *Hours of Labour.*—The ordinary working week shall not exceed 52 hours; 9½ hours to constitute a maximum day for the first five days of the week, and 4½ on Saturdays.

3. *Overtime.*—Overtime rates not to count until full time for the day has been made, this provision not to apply unless the loss of time is through the workman's own fault. Payments for overtime to be as follows:—First two hours, time and a quarter; second two hours, time and a half; afterwards, until starting time next morning, double time. When overtime is required, the question of taking meals to be arranged between employer and workman. Ordinary meal times to be deducted. Overtime in all cases to commence at the usual times for ceasing work. Sundays, Christmas Day and Good Friday also double time.

4. *Night Gangs.*—Men employed on night gangs to be paid at the rate of time and a quarter between the hours of 6 p.m. and 6 a.m.

Meal times for night gangs to be arranged between employer and workman, and ordinary meal times to be deducted.

5. *Boundary.*—The boundary shall be a radius of one mile from the Manchester Town Hall (main entrance). All men when working within the boundary shall commence and finish work at the usual times. When required by the employer or his representative to travel between the shop and the job, or *vice versa*, men shall be paid travelling time and fares. This provision also to apply to Rule 6.

6. *Travelling Expenses.*—All men working beyond the boundary mentioned in Rule 5, but within a radius of 5 miles, shall be paid travelling expenses at the undermentioned rates in lieu of travelling time and fares:—1 to 2 miles from Town Hall, 3d. per day; 2 to 3 miles from Town Hall, 5d. per day; 3 to 4 miles from Town Hall, 8d. per day; 4 to 5 miles from Town Hall, 10d. per day. All men, when paid travelling expenses, to be on the job at the usual starting and stopping times.

7. *Country Work.*—All men sent from this district beyond the distances stated in Rule 6, to be paid travelling time each way at the ordinary rates and railway fares.

When required to lodge away from home, an addition of 1s. 6d. per night to be allowed for lodgings (Sundays included).

Return railway fares only to be allowed every two weeks when working within 20 miles; over 20 miles and up to 50 miles, every month; over 50 miles, every three months.

In exceptional cases, such as breakdowns, &c., men required by the employer to travel outside the ordinary working hours shall be paid railway fares and travelling time at the rate of time and a quarter.

8. *Apprentices.*—No employer shall engage additional apprentices whilst the total number shall exceed one-third of the journeymen employed by him, taking an average over three years.

9. *Discharge.*—Should an employer require to discharge a workman, or a workman desire to leave his employment, one hour's notice shall be given on either side, or one hour's pay in lieu of such notice (except in cases of misdemeanour), which shall be added to or deducted from the workman's wages at the time of payment.

10. *Society or Non-Society Men.*—Whilst agreeing not to place any obstacle in the way of men joining the Union, employers do not agree to employ Union men only.

11. *Tools.*—Each qualified workman to have a full kit of tools, comprising:—Pair cutting pliers; pair gas pliers; heavy and light hammers; two gimlets; ratchet brace and four shall and two twist bits; 2-ft. rule; four Firmer chisels; tenon saw; 2-lb. soldering iron; half-round file; large, medium and small screwdrivers; two plugging chisels; two bradawls; square; plumb bob and line; small plane; key-hole saw; gouge; small footprint.

12. *Dirty Work.*—That extra payment be made to men when engaged on work, as follows:—(*a*) Mines, pits and old ship repairs (except oil vessels after carrying oil), 6d. per day; (*b*) chemical works, accumulator works, paint works, riverside premises and docks, where the conditions are abnormal, 6d. per day; (*c*) oil vessels after carrying oil, cleaning out or repairing old accumulators, 1s. per day.

13 *Disputes.*—No strike or lock-out to take place under any circumstances until the matter in dispute has first been referred to a joint committee of employers and operatives, who shall meet within six days and endeavour to settle. Should they fail, the same shall be referred to an umpire to be mutually agreed upon by the said committee. Wherever practicable, current conditions to prevail pending reference to the committee or umpire.

14. *Definition.*—A qualified electrical wireman and cable jointer must be over 21 years of age, able to produce indentures of apprenticeship or references proving not less than five years' employment in general electric contracting work, or, alternatively, must produce a certificate from some recognised authority.

15. *Alterations to Rules.*—No alteration shall be made in these rules, either by employers or workmen, without giving six months' notice in writing, such notice to expire on the 1st day of May in any year.

When notice for alteration is received by either side, 14 days shall be allowed after the receipt of such notice in which to submit counter proposals, if necessary, which shall be accepted as being in order.

We, the representatives of the Manchester, Salford and District Building Trades Employers' Association on the one hand, and the Electrical Trades Union on the other, pledge our respective societies to maintain and carry out the aforesaid joint rules in each of our respective associations and societies.

Signed this 9th day of April, 1914.

On behalf of the Manchester, Salford and District Building Trades Employers' Association (Electrical Branch).
JOHN LIGHTFOOT, Chairman.
L. E. WILSON, Vice-Chairman.
JAMES DENVER, Secretary.

On behalf of the Electrical Trades Union.
WILLIAM C. MCKAY, Chairman, District Committee.
J. ROWAN, General Secretary.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

8,620. "Sparking plugs for internal combustion engines." T. MCCLEMENTS. April 6th.

8,629. "Process for the electrodeposition of iron." S. O. COWPER-COLES. April 6th.

8,630. "Driving band for projectiles." S. O. COWPER-COLES. April 6th.

8,631. "Process and apparatus for polishing metal sheets, plates and the like." S. O. COWPER-COLES. April 6th.

8,671. "Apparatus for lighting and extinguishing lamps at a predetermined time." A. C. A. BOUCHARD. April 6th. (Convention date April 4th, 1913, Belgium.) (Complete.)

8,683. "Method of repairing the hub of a broken electric incandescent lamp. ELECTRIC UTILITY CO., LTD. and R. W. LONG. April 6th.

8,684. "Manufacture of incandescent electric lamps." ELECTRIC UTILITY CO., LTD. and R. W. LONG. April 6th.

8,695. "Electrical connections." SOC. ANON. LE CARBONE. April 6th. (Convention date, April 7th, 1913, France.) (Complete.)

8,699. "Electro-dynamic apparatus for driving machines." B. GRAEMIGER. April 6th. (Convention date, May 26th, 1913, Switzerland.) (Complete.)

8,700. "Electro-dynamic apparatus for driving machines." B. GRAEMIGER. April 6th. (Convention date, January 10th, 1914, Switzerland.) (Complete.)

8,717. "Electric regulating devices." BRITISH THOMSON-HOUSTON CO., LTD. and D. E. JEWITT. April 6th.

8,718. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD. and G. J. RALPH. April 6th.

8,719. "Electric heating and cooking devices." R. SPRENGER. April 6th. (Convention date, April 7th, 1913, Germany.) (Complete.)

8,757. "Plugs and switches for electric current." R. M. H. RANDELL and L. G. LANE. April 7th.

8,789. "Electro-deposition of metals." S. O. COWPER-COLES. April 7th.

8,790. "Electro-deposition of iron." S. O. COWPER-COLES. April 7th.

8,794. "Duplex connection for two telephone lines connected with a relay for reinforcing telephone currents." P. L. M. DRUMAUX. April 7th. (Convention date, October 23rd, 1913, Belgium.) (Complete.)

8,795. "Projectile and process of manufacturing the same." S. O. COWPER-COLES. April 7th. (Complete.)

8,798. "Electrical machines." D. F. JUAN. April 7th.

8,800. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT-GES. April 7th. (Convention date, April 7th, 1913, Germany.) (Complete.)

8,804. "Electric welding." E. H. JONES and LIGHT STEEL TUBULAR WHEELS, LTD. April 7th.

8,806. "Holders for electric glow lamps." C. A. SCHAEFER. April 7th. (Convention date, April 15th, 1913, Germany.) (Complete.)

8,807. "Holders for electric lamps." C. A. SCHAEFER. April 7th. (Convention date, January 2nd, 1914, Germany.) (Complete.)

8,814. "Electrically heated Instruments." J. A. CHAPMAN. April 7th. Convention date, May 6th, 1913, United States.) (Complete.)

8,821. "Electric cut-outs." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 7th.

8,828. "Electric cables." J. F. WATSON and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,831. "Telephonic systems." E. A. GRAHAM and E. A. SANFTLEBEN. April 7th. (Addition to 767/14.) (Complete.)

8,841. "Electric cables." J. F. WATSON and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,842. "Electric cables." W. F. PRICE and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,855. "Electric lighting systems of motor-cars." B. BROOKS and W. HOLT. April 8th.

8,880. "Road vehicle electric lamps." J. LAWRENCE and HOWES & BURLEY, LTD. April 8th.

8,881. "Microphones and the like." E. B. BADCOCK. April 8th.

8,889. "Motor-starting switches, rheostats, and the like." SIEMENS BROS. DYNAMO WORKS, LTD. & E. SCHUPP. April 8th. (Complete.)

8,904. "Electro-mechanical movements." W. M. MORDEY. April 8th.

8,906. "Telephonic systems. E. A GRAHAM, W. J. RICKETS and E. A. SANFTLEBEN. April 8th. (Addition to 6,356/14.) (Complete.)

8,916. "Electrical regulation devices." R. BOSCH (Firm of) and G. HONOLD. April 8th. (Addition to 27,961/13.) (Complete.)

8,931. "Magnetos and other electric generators." A. KELLER-DORIAN. April 8th. (Convention date, April 14th, 1913, France.) (Complete.)

8,943. "Apparatus for indicating the lighting and extinguishing of electric lamps." F. O. SCHROEDER. April 8th.

8,946. "Automatic or semi-automatic telephone systems." G. A. BETULANDER, N. G. PALMGREN and O. GRAHN. April 8th. (Complete.)

8,947. "Resistance elements applicable to electric lamps, electric heaters, and other purposes." J. R. QUAIN. April 8th.

8,957. "Controlling devices for alternating current circuits." Igranic Electric Co., Ltd. (Cutler Hammer Mfg. Co., United States.) April 9th. (Complete.)

8,973. "Electric filament lamps." S. Johnson. April 9th.

8,982. "Electrical wiring installations." Concordia Elektrieitats Akt-Ges. April 9th (Convention date, April 12th, 1913, Germany.) (Complete.)

8,985. "Alternating-current motors." J. Lecoche. April 9th.

8,990. "Galvanometer for detecting and measuring physiological, geological, aerial and other electric currents." W. H. Meredith. April 9th.

9,021. "Automatic electric signs." R. Gross. April 9th.

9,030. "Electrical machines." Don F. Juan. April 9th.

9,035. "Electric switches." J. H. Tucker and J. A. Crabtree. April 9th.

9,054. "Self-luminous electric switch button and the like." W. Springmann. April 9th.

9,056. "Methods of and apparatus for shaping filaments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (April 9th.)

9,065. "Method and means for protecting apparatus on alternating-current systems." A. G. Collis and Crompton & Co., Ltd. April 9th.

9,092. "Electric relay systems." H. de Forest Arnold. April 9th. (Addition to 29,384/12.) (Complete.)

9,093. "Alternating-current electromagnets." R. Waygood & Co., Ltd., H. P. Amphlett and H. C. Walker. April 9th.

9,103. "Circuit arrangements for telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges, Germany.) April 9th. (Addition to 22,013/10.) (Complete.)

9,104. "Magnetos for motor-cycles." A. Garelli. April 9th. (Complete.)

9,105. "Telephone exchange circuits." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt-Ges, Germany.) April 9th. (Addition to 4,698/12.) (Complete.)

9,109. "Electrical distributing switches." F. S. Gauntlett. April 9th.

9,110. "Incandescent electric lamps." C. Gladitz. April 9th.

9,123. "Joints for metallic conduits for electric cables." Simplex Conduits, Ltd. and L. M. Waterhouse. April 11th. (Complete.)

9,134. "Electrically controlled block systems for railways." J. Sayers, W. C. Achfield, G. Salt, and B. W. Cooke. April 11th.

9,175. "Apparatus for controlling the lighting power of an electric lighting plant." Soc. Anon. des Automobiles et Cycles Peugeot. April 11th. (Convention date, April 10th, 1913, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

29,057. Printing Telegraphs. E. C. R. Marks (General Engineering & Construction Co.). December 17th.

1913.

1,505. Electrically Operated Steering-gear. British Thomson-Houston Co. (General Electric Co.). January 18th.

4,635. Advertising Devices and the like. H. K. Harris. February 24th. (Patent of addition not granted.)

4,779. Receiving-apparatus for Wireless Telegraphy. F. J. Chambers. February 25th.

6,122. Interrupters for Electric Circuits. A. Pollak. March 12th. (March 20th, 1912.)

6,371. Electric Regulating Switches. L. Miller & L. Boothman. March 14th.

6,421. Means for Operating upon Earthenware, Chiefly in the Production of Electric Insulators and the like. H. L. Doulton & H. Morris. March 15th.

6,799. Electric Transformer Arrangements. British Electric Transformer Co. & R. Crosbie-Hill. March 19th.

6,817. Electric Cables. A. T. Mirza. March 19th.

6,873. Electrical Switches. British L.M. Ericsson Manufacturing Co. and A. G. Rogers. March 20th.

6,887. Automatic Morse-recorder. W. B. Good & Rebesi, Ltd. March 20th.

6,900. Means for Protecting Direct-current Working Electrical Instruments from being Operated by Extraneous or Unauthorized Currents which may reach the line to the instrument by accident or design. R. Dormer. March 20th.

6,950. Electric Dry Batteries. C. Stern. (Hubert.) March 20th.

7,125. Test Circuit Arrangements for Telephone Systems. Siemens Bros. & Co. & W. H. Grinstead. March 25th.

7,127. Circuit Arrangements for Telephone Exchanges with Automatic Selecting Devices. Siemens Bros. & Co., and T. Pettigrew. March 25th.

7,156. Dynamo Regulators. W. J. Mellersh-Jackson. (Egyuem.) March 25th.

7,211. Motor-car Lamps. R. H. Matzke. March 26th.

7,244. Supports for Electric Lamps. H. Wade. (Schneider & Naujoks Elektrizitäts Ges.) March 26th.

7,246. Electric Lamp Fittings. H. Wade. (Schneider & Naujoks Elektrizitäts Ges.) March 26th.

7,282. Engine Starting Devices. S. I. Prescott. March 27th.

7,305. Overhead Conductors for Electric Traction Systems. K. D. Bowen & Cedes Electric Traction, Ltd. March 27th.

7,369. Switches for Electrically Operating Planing Machines and the like. Lancashire Dynamo & Motor Co. & W. Hargreaves. March 28th.

7,411. Flame Arc Lamps. G. E. Tate & F. O. Monkhouse. March 28th.

7,396. Self-inductances or Tuning Coils. Graham & Latham, Ltd., and B. F. Sobotka. March 28th.

7,592. Lamp Covers. W. S. Sholl. March 31st.

7,600. Dynamo-electric Machines. British Thomson-Houston Co., F. H. Clough, and L. Dunker. March 31st.

7,610. Transmitting Apparatus for Use in Wireless Telegraphy and Telephony. G. Marconi and C. S. Franklin. March 31st.

7,977. Detectors for Use in Wireless Telegraphy. Graham & Latham, Ltd., and L. J. Graham and B. F. Sobotka. April 4th.

9,144. Fuses or Cut-outs for Electric Circuits. C. W. Cox. April 18th.

9,166. Observation Circuits of Telephone Systems. Siemens Bros. & Co., and D. A. Christian. April 18th.

9,449. X-Ray Tubes and the like and the Manufacture thereof. C. E. Friedrich. April 22nd.

10,004. Electric Incandescent Lamp Holders. H. T. Wilkinson. April 29th.

10,036. Apparatus for the Direct Conversion of Heat into Electricity. J. Gyuris & Allois Schlesinger (Firm of). April 29th.

10,252. Substitution Resistances for Electric Lamps. W. Heins. May 1st. (March 11th, 1913. Addition to 9,530/13.)

10,685. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt.-Ges. May 6th. (May 6th, 1912.)

10,304. Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.). May 1st.

11,057. Electric Time Switches. H. F. J. Thompson & J. H. Bowden. May 10th.

11,755. Electric Ceiling Roses. G. Markt. May 20th. (Cognate Application, No. 24,586/13.)

12,404. Means for Securing Shades, Reflectors, or other Attachments to Electric Lamp Holders and the like. G. St. J. Day. May 28th.

12,651. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt.-Ges. May 30th. (July 8, 1912.)

12,839. Indicating Appliances for Electric and other Measuring Instruments. British Thomson Houston Co. and F. Holden. June 2nd.

13,023. Form of Electric Dimming Switch. L. Hulbert. June 5th.

13,249. Electric Light Fittings. G. Vale and R. H. Best. June 7th.

13,587. Automatic Adjustable Electrical Overload Circuit Breakers. H. T. Holmes & J. Kemp-Welch. June 12.

13,656. Systems of Electric Distribution. British Thomson-Houston Co. (General Electric Co.) June 12th.

13,684. Magnetic Compasses for Ships' Boats or the like. C. A. Bartlett & T. W. Bruce. June 13th.

14,071. Electric Arc Lamps. A. H. Railing and A. E. Angold. June 18th.

14,083. Magnetic Compasses and like Instruments. E. W. Barker. June 18th.

14,384. Apparatus for Indicating the Approach of Trains. T. Gibson, G. A. Farmer & E. Kead. June 21st.

15,086. Connections for Electric Tariff Meters. C. G. Lundgren. June 30th.

15,148. Securing of Windings in Dynamo-electric Machines. Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koettgen and E. O. Kieffer. July 1st.

15,293. Apparatus for Producing Sulphuric Acid. British Thomson-Houston Co. (General Electric Co.). July 2nd.

15,327. Lead Accumulators. G. C. Dymond. (Marquise des Ligneris.) July 3rd.

16,467. Miners' Safety Lamp. F. Faerber. July 17th.

16,691. Electric Water-gauges. J. Rajczy. July 21st.

16,985. Apparatus for Uniformly Heating Interior Cavaties of a Living Body by Electro-diathermic Treatment. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). July 24th.

17,268. High Speed Rotors for High-frequency Multipolar Electrical Machinery. R. Goldschmidt. July 28th. (Addition to 10,507/12.)

17,490. Process for Heating Articles in Electric Furnaces. F. Fischer. July 30th. (November 5th, 1912.)

17,584. Vents for Electric Accumulator Cases and Other Receptacles. H Lucas & O. Lucas. July 31st.

17,607. Spark Discharges for the Ignition Systems of Internal-Combustion Engines and for Other Purposes. R. Varley. July 31st.

18,160. Telephone Locking System. W. A. Morse & A. M. Morse. August 9th.

19,212. Multiple-way Insulating-Sleeve as Separator between Conductors on Cable Joints. R. B. Mitchell & F. J. Cooper. August 25th.

19,743. Apparatus for Controlling from a Distance and for Regulating the Speed of the Propelling Turbines of a Ship. Soc. Anon. Italiana Gio. Ansaldo & Co. September 1st. (October 10th, 1912.)

19,916. Electric Lamp Sockets. E. P. Le Compte and C. W. Hodgson. September 3rd.

20,195. Bonding Clamp for Metal-Sheathed Electric Wires and Cables. W. T. Henley's Telegraph Works Co. & W. F. Bishop. September 6th.

20,300. Method of Packing the Joints of Metal Vapour, Alternating Current Rectifiers and other Vacuum Apparatus. E. Hartmann. September 8th. (September 21st, 1912.)

20,577. Trough or Channel Reflector Electric Light Devices. J. P. Child. September 11th.

23,013. Fume-Condensing Attachment for Arc Lamps. H. G. Dyer & C. S. Adams. October 11th.

23,321. Theatrical or Stage Illusion. L. McCormick. October 15th.

24,017. Electric Driving Mechanism for Rotary Printing Presses and Paper Calendering Machines. Siemens-Schuckertwerke Ges. October 23rd (October 23rd, 1912.)

24,777. Connections and Fittings for Electric Conduits. C. Birch. October 31st.

25,465. Colletor Brushes for Electrical Apparatus. W. Christie (Galvanische Metall-Papier Fabrik A.ct.-Ges.). November 7th.

25,586. Electrical Candle Lamps. A. E. Watson & Veritys, Ltd. November 8th.

25,666. Electric Light Pendants. F. Dehler. November 10th. (February 15th, 1913.)

25,975. Method of and Means for the Electric Transmission of Signals and Speech in Mines R. Haddon (Reineke.) November 12th.

26,060. Electrical Devices for Operating Door-sashes of Automobiles and other Vehicles. J. F. P. De La Riboisiere. November 13th. (December 21st, 1912, Addition to 15,648/13.)

27,543. Arrangements for the Conversion of a Periodically Variable Movement of Small Energy into a Movement of Great Energy Taking Place According to a Similar Law. Fried. Krupp Akt-Ges. November 29th. (January 2nd, 1913.)

27,875. Electricity Meters. Korting & Mathieson Akt-Ges. December 4th. (May 16th, 1913.

28,734. Galvanic Cells. J. Zaruba & Co. December 12th. (December 13th, 1912.)

30,082. Accumulators and Electrodes Therefor. Svenska Ackumulator Arktiebolaget Jungner. December 31st. (December 31st, 1912.)

1914.

945. Electric Time Switches. J. E. H. Beraud. January 13th. (January 23rd, 1913.)

1,119. Electrical Accumulators. C. De Sedneff. January 15th. (Divided application on 1,066/13. January 14th.)

5,414. Electrode-Holders for Electric Furnaces. Fried. Krupp Akt.-Ges. March 3rd. (December 13th, 1913.)

5,501. Means for Operating upon Earthenware, Chiefly in the Production of Electric Insulators and the like. H. L. Doulton & H. Morris. March 4th. (Divided Application on 6,421/13. March 15th.)